ANALYSIS, DESIGN AND IMPLEMENTATION OF A DIGITAL MENTAL HEALTH PLATFORM

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Approval sheet of the Thesis

This is to certify that we have read this thesis entitled “ANALYSIS, DESIGN AND IMPLEMENTATION OF A DIGITAL MENTAL HEALTH PLATFORM” and that in our opinion it is fully adequate, in scope and quality, as a thesis for the Bachelor Degree of Computer Engineering.

Dr. Igli Hakrama
Date: July, 2022

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ABSTRACT

ANALYSIS, DESIGN AND IMPLEMENTATION OF
A DIGITAL MENTAL HEALTH PLATFORM

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The creation, design, and use of web applications that are focused on mental health care (E-mental health) present several advantages when compared with traditional mental health methods being applied nowadays.

In this research/thesis, I have proposed a web-based mental health platform, which focuses on raising people's awareness and increasing their attention toward mental health care.

The platform is intended to serve as a tool to educate people by making them realize that mental health care is a necessity and not a luxury, by involving them in the studies/surveys directly, and by presenting them with live infographics based on people's responses and interaction.

At any time the system/platform will keep the users' anonymity and confidentiality and create a secure environment for them to interact. The web application proposed, would have on top of it verified psychologists who will have the privilege to create studies/surveys and spread them among the user, get results, and give conclusions. The system is designed to operate in three environments. "Base-user" is an environment that will be accessible for any type of user, every registered and verified psychologist who can create and share her/his studies/surveys among other users. "Business" will be an

environment that will serve any business which will want to register, get verified, and find a psychologist for its employees. “Education” is the other environment that will have in focus psychologists in educational institutions. The platform will make it available for students to complete the school’s psychologist studies/surveys in a digital way. On the other hand psychologists, parents, and governing bodies of education will get insights into the “educational trend” and help them in decision making.

In conclusion, a new mental health platform approach is proposed bringing a novel contribution to the currently developed market. The conducted research demonstrates through design schemas and software implementation the highly impactful role of the psychologist as a main leading influential in the proposed mental health platform.

Keywords: mental health, platform, interaction, psychologist, environment, survey, study

ABSTRAKT

ANALIZA, DIZENJIMI DHE IMPLEMENTIMI I NJË PLATFORME DIGJITALE PËR SHËNDETIN MENDOR

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Krijimi, dizenjimi dhe përdorimi i aplikacioneve të internetit të cilët janë të fokusuar në kujdesin e shëndetit mendor (E-shëndeti mendor) prezantojnë shumë avantazhe krahasuar me metodat tradicionale të shëndetit mendor që aplikohen sot.

Në këtë kërkim, unë kam propozuar një platformë digjitale për shëndetin mendor, e cila fokusohet në rritjen e ndërgjegjësimit të njerëzve dhe rritjen e vëmendjes së tyre kundrejt kujdesit për shëndetin mendor.

Platforma synon të shërbejë si një mjet për të edukuar njerëzit duke i bëre ata të kuptojnë se kujdesi për shendetin mendor është një domosdoshmëri, dhe jo një luks, duke i përfshirë drejtëpërdrejtë në studime apo anketime dhe duke i prezantuar atyre grafikë në kohë reale bazuar në përgjigjet e përdoruesëve të tjerë në platformë.

Në çdo kohë, sistemi/platforma do të ruaje anonimitetin dhe konfidencialitetin e përdoruesve dhe do të krijojë një mjedis të sigurtë për ta që të ndërveprojnë. Ueb aplikacioni i propozuar, do të ketë në krye të tij psikologë të verifikuar, të cilët do të kenë privilegjin të krijojnë studime/anketime dhe t'i përhapin ato në mesin e përdoruesve, të marrin rezultate në kohë reale dhe të japin përfundime. Sistemi është projektuar për të funksionuar në tre mjedise. "Përdorues bazë" është një mjedis i cili do të jetë i aksesueshëm për çdo lloj përdoruesi, çdo psikolog të rregjistruar dhe të verifikuar që mund të krijojë dhe ndajë studimet/anketat e saj/tij mes përdoruesve të tjerë. "Biznesi"

do të jetë një mjedis që do t'i shërbejë çdo biznesi që dëshiron të regjistrohet, të verifikohet dhe të gjejë një psikolog për punonjësit e tij. “Edukimi” është mjedisi tjetër që do të ketë në fokus psikologët në institucionet arsimore. Platforma do të bëjë të disponueshme për studentët që të kryejnë studimet/anketimet e psikologut të shkollës në mënyrë digjitale. Nga ana tjetër, psikologët, prindërit dhe organet drejtuese të arsimit do të marrin njohuri për "prirjen e edukimit" dhe do t'i ndihmojë ata në vendimmarrje.
Si përfundim, ne kete studim po propozoj një qasje e re e platformës së shëndetit mendor duke sjellë një kontribut të ri në tregun e zhvilluar aktual. Hulumtimi i kryer demonstron përmes skemave të projektimit dhe zbatimit të softuerit rolin shumë ndikues të psikologut si një udhëheqës kryesor me ndikim në platformën e propozuar të shëndetit mendor.

Fjalët kyçe: shëndeti mendor, platformë, ndërveprim, psikologë, mjedis, anketim, studim

Dedicated to my beloved family…

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LIST OF ABBREVIATIONS

MH	Mental Health
WHO	World Health Organization
MHIS	Mental Health Information Systems
E-MH	Electronic Mental Health
NIPT	“Numri i Identifikimit te Personit te Tatueshem”
NUIS	“Numri Unik i Identifikimit te Subjektit”
NFR	Non-Functional Requirement
UX	User Experience
BPMN	Business Process Model and Notation
POV	Point of View
NFR	Non-Functional Requirement
HTTP	Hypertext Transfer Protocol
TCP	Transmission Control Protocol
HTML	Hypertext Markup Language
DOM	Document Object Model
CSS	Cascade Style Sheets
JS	JavaScript
AJAX	Asynchronous JavaScript and XML
XML	Extensible Markup Language
JSON	JavaScript Object Notation
SQL	Structured Query Language
MySQL	My Structured Query Language
MVC	Model View Controller
UI	User Interface
GUI	Graphical User Interface
UML	Unified Modeling Language

ICT	Information and Communications Technology
PII	Personally Identifiable Information

CHAPTER 1

INTRODUCTION

Our psychological, emotional, and social well-being are all important parts of our mental health. They impact the way we feel, think, and act. Furthermore, they influence how we deal with stress, interact with people, and make decisions. Mental health is crucial at all life stages, from childhood until adulthood [1].

Unfortunately, anything related to mental health has a big stigma, which is why it's critical that we recognize effective mental health initiatives and try to eliminate the hurdles that have been erected to prevent us from treating mental health in a positive, constructive manner [2].

In terms of data collection and mental health support technology has brought a revolution to the concept. New ways to gain better knowledge of MH are being developed and presented to the general public through smartphones and tablets. Researchers, psychologists, and healthcare providers are using these technological advancements in their everyday routine to track patient progress and provide proper treatment [3].

The application and usage of technology and the internet to store and analyze MH data, to provide services is known as E-mental health care. These technology-related solutions aim to encourage and motivate people by explaining the importance of designing and creating mental health services that ensure health promotion, screening, and treatment. Being an important link between the patient and professional psychologists, these e-mental health solutions can improve not only the actors' routine, but also provide professional education and even contribute to academia by helping directly mental health researchers, providing them real-time data. Moreover, e-MH systems can store personal data to diagnose mental health issues and create tailored treatment plans to overcome treatment limitations [4].

However, resources for mental health services have not kept pace with rising demand. This has put a strain on e-MH implementations' capacity, resulting in longer queues for those needing help and assistance. Furthermore, as evidenced by the vast percentage of people who never undergo therapy, there exist significant gaps between service treatment and engagement [4].

With the number of scientific researches rising over the recent years, psychologists are inventing innovative techniques to increase productivity, assess training and development essentials, and implement MH policies in companies and enterprises. Psychological principles are used by business psychologists to affect workplace behavior. A Business Psychologist's goal is to assist businesses and their employees in achieving high levels of performance and job satisfaction [5].

Psychologists are becoming an increasingly significant part of educational institutions, as well as other industries and organizations, due to the complexity of today's educational system. They assist students and teachers in balancing their busy schedules and schoolwork. They are also engaged in research and can help improve the school curriculum by making significant changes [6].

Following the rapid increase in approaching E-MH platforms among people, notably during the Covid-19 pandemic, there is a need to create a digital platform which puts on top professional psychologists and giving them opportunity to create and share studies/surveys among users by helping people overcome their stigma about mental health and raising awareness towards the need for mental health care and support. The need for mental health must be integrated in every section of life and for every age. The platform proposed will have specific sections and will operate in three environments one for every user who want to participate in study/surveys and get live insights of other people resposnes and compare with herself/himself, one for employees and businesses and the last one for ecuational institutes for students, parents and governance oeducation bodies and help them in decision making. The platform proposed will be deployed and be accessible through network.

CHAPTER 2

LITERATURE REVIEW

2.1. E-Mental Healthcare & Self-management apps

The merging of digital technology with mental health services is known as e-MH care. This technological approach was created to address a need in healthcare for people who require mental health assistance but would not otherwise obtain psychological therapy. E-health is a multidisciplinary topic that blends technology with medical management, and community to improve healthcare delivery productivity. This implementation makes medications more tailored and accurate. E-MH care has been created as part of this to improve mental well-being by avoiding the need for psychotherapy and mental illness [4]. It is part of a solution to directly assist those in need via the use of ICT and the internet. E-MH care comprises digital technology-based therapies, through means like browsing (web-based), smartphone-based, and augmented reality-based, to create a self-managed online environment for mental well-being.

Applications that are referred as "self-management" apps require the user to enter data into the application in order for it to provide feedback. For instance, the user may use the software to create stress, sleep management or even anxiety tools, or set up drug reminders. Certain software may track the user's performance and provide feedback by measuring pulse rate, respiration patterns, hypertension, and other factors [3]. Furthermore, as young individuals migrate to adult care services, smartphones have been assisting in the improvement of the treatment of chronic illnesses.

2.2. Previous related work

Digital mental health has been examined in a variety of areas, including healthcare, psychology, communications, and ICT. Researchers' interest in the topic has steadily increased. One research looked into several sorts of self-management interventions based on digitalized mental health approaches [7]. Other research [8] [9] investigated the efficacy of e-based self-help treatments and behavioral interventions for mental health issues, such as remote therapy for obsessive compulsive disorders [10] [11], online treatment for depression [11], and web-based interventions for alcoholism [12]. Another research looked at the benefits and drawbacks of social networking services on the internet [13]. These researches have revealed some possible advantages to e-mental health that have emerged as a result of the dynamics of a new scientific field. In the field of e-mental health research, the number of studies has continuously increased (Figure 1). In 2015, the number of researches and papers published relating to e-MH increased, reaching 789 records in 2019. The first paper connected to e-health research was published in 2000 and was indexed by Clarivate Analytics tools, according to the WoS data analysis [4].

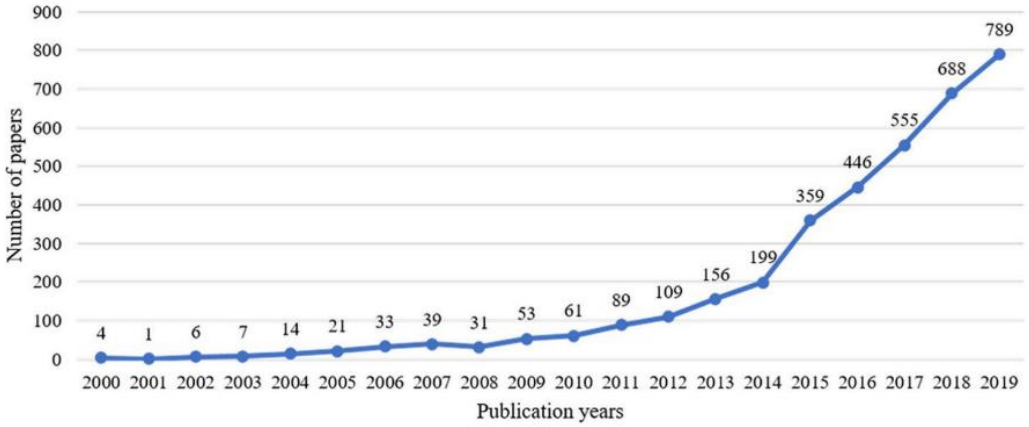

Figure 1. E-mental health published papers 2000-2019, indexed by Clarivate Analytics tool ***[4]***

2.3. Importance of Mental Health Information Systems (MHIS)

The MHIS is defined as a system for action, meaning it should exist not only for data collection but also for knowledgeable decision-making considering all mental health system characteristics [14]. A mental health information system collects, analyzes, propagates, and uses data on mental health services for the people it serves. MHIS aspires to increase the efficacy and efficiency of mental health services while also ensuring more equitable delivery by empowering executives and service contributors to make better-informed decisions about treatment quality [15].

2.4. Evolution of technology and how Data Science helps Mental Health

The availability of powerful computers and so-called big data from several sources implies that data science techniques are becoming more prevalent. However, its implementation in mental health research is frequently believed to be at an earlier level than in other disciplines, although the intricacy of mental health and sickness necessitates such a comprehensive approach.

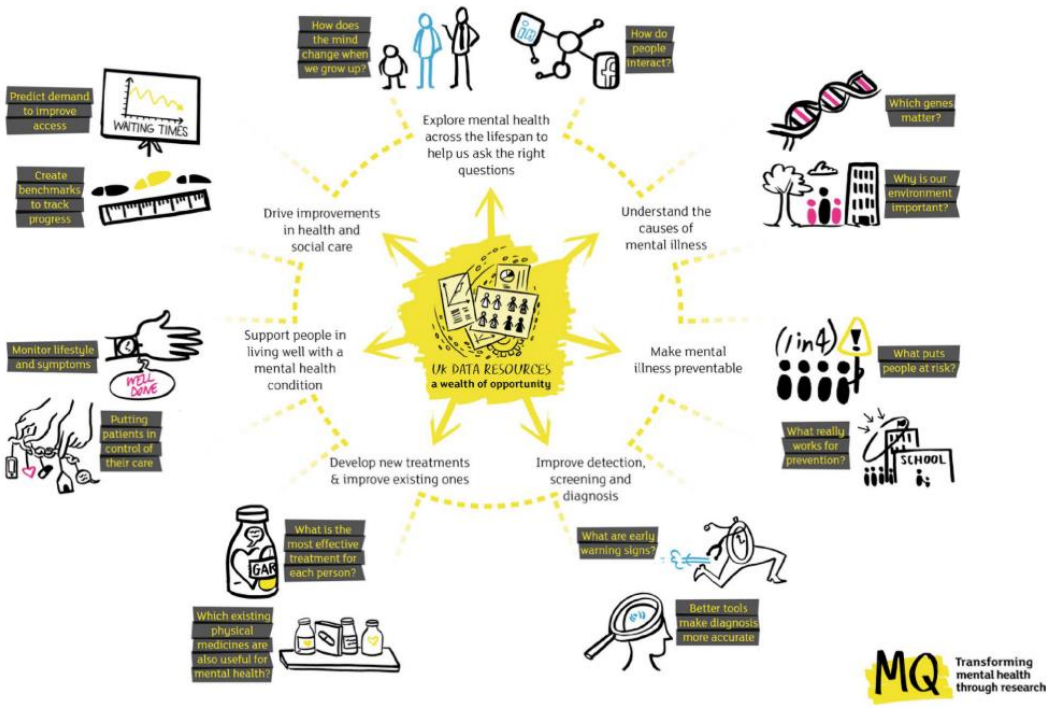

Figure 2. What is the role of data science in mental health research? Figure of MQ Transforming Mental Health ***[16]***

Smartphone apps are now capable of online-remote patient monitoring of symptoms or other health metrics. Some applications may provide a platform for smart evaluations and recommendations personalized to the specific remote user, using data science methodologies. The quality and evidence foundation for health-related applications, on the other hand, varies. They may in real-time establish a communication link with caregivers and clinicians, do a rapid assessment and provide direct feedback, and provide automatic remote assistance. Apps have been shown to lower anxiety, stress, drug abuse, and the number of suicides. There exist a variety of self-management applications which allow patients to track their emotions and help them control panic episodes. This MH perspective extends beyond the person to encompass the community and societal systems wherein people are embedded [16].

2.5. How the Covid-19 pandemic raised awareness towards Mental Health and “tele-healthy”

COVID-19 has increased the burden of mental illness on employees and their families. Following the initial breakouts and lockdowns, there was a worldwide increase in tension, anxiety, and depression symptoms. A long-term pandemic, changing working circumstances, and an economic downturn will all raise the frequency of mental health issues and disorders. In a day of constrained resources and social isolation, digital tools provide an opportunity for employers to broaden the volume and scope of services across critical stages of mental health assistance: prevention, identification, support and treatment, and maintenance of recovery. Employees can benefit from digital solutions that assist minimize obstacles to access and usage of mental health treatments, such as stigma, lack of knowledge, long wait times, inconvenience, and expense. Employers and insurers can use digital technologies to identify areas of need and improve support during times of limited resources to maintain worker well-being and productivity. Employers and insurers must also strive to establish healthier workplaces and communities by recognizing and reducing the underlying causes of distress caused by working and living situations, as well as by fostering cultures that promote well-being.

During the early outbreaks and lockdowns, people rushed to well-being apps and telehealth to avoid overwhelming healthcare systems or getting or transmitting COVID-19. In April, the top ten well-being applications had 2 million more downloads (a 25% increase) than in January 2020. Virtual consultations as a percentage of total outpatient visits in the United States increased from less than 0.01% before the epidemic to 69% in mid-April, before falling to 21% in July. Tele-therapy compensated for fewer in-person visits, particularly for pre-existing anxiety and despair, and reversed an initially significant reduction in care delivery. As the epidemic spreads, digital health is becoming the new standard. According to a global poll conducted by Oliver Wyman, 59% of those who

utilized telehealth this year want to continue using it since it saves time and money, with users in China, Germany, and Singapore being the most enthusiastic [1].

2.6. Government policy & requirements in creating Mental Health systems

WHO wants mental health to be a worldwide development priority [17]. The idea that enhancing MH should be a strategic objective for healthcare professionals all around the world, is gaining traction. The emphasis is shifting toward living well, avoiding difficulties, and enhancing therapy services. The cross-government programme "No Health Without Mental Health" in the United Kingdom promotes the premise that "working well, developing well, living well, and aging well" will result in fewer people getting mental health problems [3] [18].

2.7. Data visualization and use of infographics in healthcare information systems

Data visualization delivers modern advances in health care, particularly in identifying patterns and interrelation with improved data processing techniques. Visualization of related data points or low infographic elements of a small dataset is an excellent source of social network distribution. Furthermore, dynamic and reactive interfaces can assist health professionals in doing faster information analysis on large datasets. Finally, it has the potential to reduce analysis time and potentially save lives. As a result, the authors describe the various data-driven technologies as well as their significance in the healthcare business. In recent years, data visualization has been considered an important component

in the assessment and administration of medical services. For instance, researchers at Duke University created a graphical tool to evaluate illness symptoms and risk factors [19]. They stated that in this big data generation, there are numerous possibilities for developing innovative ideas to interpret, manage, and organize data. This digital approach is largely required to solve common medical errors by helping nurses, doctors and especially mental healthcare providers in fully comprehending the disease and providing proper treatment. Digital health patient observation programming frameworks record and display patient data in simple-to-understand forms, supporting healthcare providers by filling a gap in patient management. To display their information, several healthcare facilities have begun to create personalized visuals, charts, and graphs. Furthermore, depending on the data that the user wants to search for, this customizable tool is adaptive and interactive. Several institutions, such as the Institute of Health Metrics and Evaluation, implement customized data visualization charts (GBD, 2020) similarly, the National Center for Healthcare Statistics (2019) has several intriguing customizable graphics that understandably arrange big datasets.

2.8. How Business Intelligence dashboards can be adopted by citizens in healthcare (Norway use case)

Erna Solberg, the Norwegian Prime Minister, authored articles and blog entries in 2013 about the need for IT solutions for measuring and making quality data available for citizens to evaluate and make educated choices. Other European nations have IT solutions as major foundations in their health systems, and Norway should follow their lead to provide better healthcare to its population [17]. Business Intelligence (BI) technologies such as dashboards can help Solberg's aims, and the Norwegian health management has already produced numerous dashboards for residents. BI is a catch-all word for offering tools, architecture, applications, strategies, and procedures to help people make better decisions. A dashboard is a prominent tool that helps decision-makers to stay close to the

data [20] by visualizing (KPIs) [21]. The fundamental purpose of a business intelligence dashboard is to aid decision-making, which should not be disregarded in favor of other elements like visualization, architecture, or design. The proper application of BI technology, techniques, and methodologies may help to increase data quality and update. To recap, a business intelligence dashboard should be easy enough to engage users while yet being detailed enough to help them make decisions [22].

CHAPTER 3

ANALYSIS AND DESIGN OF MENTAL HEALTH PLATFORM

3.1. User Characteristics

The term "user characteristics" refers to the general attributes of the target market for a product, including those that may have an impact on usabilities, such as technical proficiency, experience level, and level of education. The description should also provide context for why particular specific needs are later included in the specific requirements [23].

The system has in abstraction 3 types of users, which depending on their actions and use of the MH platform can behave like different actors.

1. Base-Users: include all kinds of people who can register, authenticate and use the MH platform to complete studies and get insights from them. Depending on its level general user can be a “General-user” which is an actor who can enter the system, interact, complete studies, and get insights from them for free. “Employee” is called a base-user whose account is created and paid by the business he is employed to. He gets some extra features like personalized studies and direct chats with psychologists. “Parent” is a base-user actor whose account is associated with the school its children are part of. This actor can get an insight into the school studies and also direct chat with school psychology.

2. Psychologists: include all licensed psychologist which can register, verify, authenticate and use the MH platform to create studies and interact with Base-users. Psychologists get in real-time insights and use their results on their own.

Depending on its level psychologist can interact for free with “General users”. If a psychologist gets a contract with a business he can interact with the “Employee” type of user and if it gets a code by the school he can serve as a psychologist for the school.

3. Business: include all registered businesses with a NUIS/NIPT which can register, verify, authenticate and use the MH platform for their enterprise. Businesses can contact different psychologists and make a contract with them. The contract will state that psychologist will offer its service to a fixed number of accounts of the employees of the company decided by the business. The business has to pay for the accounts to the system and can leave extra payment for the psychologist contracted.

3.2. Requirements Specification and Analysis

Requirements are a set of tasks that the system is expected to do. They also define how a system reacts to specific inputs and circumstances [24].

3.2.1. Functional Requirements

1. Administrator functionalities:

The administrator can be logged in to the platform/system by authenticating with his credentials (email, password). He has all the privileges to see and delete all the accounts of the system. The administrator is also responsible for taking the registration information that businesses and psychologists enter into the system, and verifying it. In the end, the administrator decides to approve or reject the account of the business/psychologist applied. Administrators will have the opportunity to register schools and create activation

codes so they can give it to their school's psychologist to access the "Education" environment.

2. "Base-user" functionalities:

As explained before, a "Base-user" is registered through a separate form and can be authenticated with her/his credentials (email, password). The system wants every "Base-user" to be anonymous throughout the platform, so it only requires a nickname. The user has the privilege to select between three environments: "General", "Business", and "Education". Every "base-user" can access the "General" environment for free. She/he can participate in a study/survey created by a psychologist and also get insight into other user responses in form of infographics. A business can give this user the right to access the "Business" environment by paying him an account. Theoretically, this business will be the business where the user is employed. In this environment, the user will have more privileges like interacting directly with the company's contracted psychologist and also completing personalized studies/surveys. The "Education" environment will be available for those users which are parents and the school where their child/-ren is/are registered have assigned them as their parent. They will have the privilege to see the results of the studies and also contact directly with the school psychologist, but at the same time remaining the identity of every child is anonymous.

3. Psychologist functionalities:

A psychologist is registered through a separate form. She/He must provide her/his license number in order so the administrator can verify and approve his account. A psychologist can log in to the system/platform using his credentials (email, password). She/He has the privilege to select between three environments: "General", "Business", and "Education". In the "General" environment psychologist can create study/surveys and release them to every "general-user", so they can complete them. A psychologist can get insights in form of infographics every time for each of her/his studies' responses. A psychologist can access the "Business" environment if they are contracted by a business. They can chat

directly with a business and also get a contract from them. When the contract is reached based on the number of accounts agreed psychologist has the responsibility to interact with those users (who theoretically are the employees of the company). This environment gives the psychologist to interact with the user/" employee" directly and also create and share studies with all the employees or individually. To access the "Education" environment psychologist must enter an activation code (which theoretically will be given to her/him, not through our system/platform). Activation codes will be created by an administrator and saved in the database system. Once a psychologist enters the activation code, he will be responsible to create classes, creating student profiles, and also creating studies. Since students will be aged 10-15, they can not open their account, psychologist will have the privilege to open a live session by entering the NID of the student and also selecting the study. Students must complete the study in privacy.

4. Business functionalities:

Business is registered through a separate form. It must provide its NUIS/NIPT in order so the administrator can verify and approve its account. Businesses can log in to the system/platform using their credentials (email, password). It will have the privilege to see the list of all psychologists, contact them directly, and offer them a contract. He must put in the contract the number of accounts he needs to be managed by the psychologists (employee's account) and also the payment. The business will have the opportunity to get real-time insights in form of infographics about the results of the studies completed by their employees but remaining their identity of them anonymous.

3.2.2. Non-functional requirements

Non-functional requirements constrain the system. They are in charge of assessing the software's quality. Non-Functional Requirements are a type of requirement that are used to address major software quality issues [25]. If NFRs are not appropriately treated, according to [25], the following effects may occur:

- Unsatisfaction between users, clients and developers.
- Software inconsistency.
- Fixing the program that was prepared without considering NFRs resulted in a time and cost overrun.

3.2.2.1. Usability:

MH platform proposed should be easy to navigate, learn, work & adapt for each user. Every user must be comfortable and effortless to access it. Video tutorials can be placed in each of the registration parts explaining what our system is doing, how to navigate through the system, and how that user can benefit.

Pop-up messages are going to alert the user when she/he tries to enter the wrong input ex. login, filling documentation, and editing profile. The system will beautifully handle errors in order to satisfy UX and also minimize errors by displaying/suggesting a solution to the pop-up message.

I am trying to make the navigation to the system, following the methodology "Click & Go". Structuring the dashboards to be user-friendly and also simple. I want the user to complete his jobs with only a few clicks, limiting the usage of text input and scrolling. Using this methodology, I will decree the possibility of errors while navigating and using my proposed MH system.

When an operation is considered "dangerous" ex. deleting records, we will prompt a message and ask for a double confirmation from the user.

3.2.2.2. Performance Requirements

MH platform proposed is a web application product for all end-users, meaning it will be used directly from the browser. Mentioning that the main requirement will be the internet connection. A minimum of 4 Mbit/sec is required to have a minimal experience with the system. Is recommended a +15 Mbit/sec speed in order so the user experience can be smooth and reliable.

The system is expected to be affected when a critical number of users (traffic) are using and especially conducting surveys at the same time.

Overall 97% of transactions will be processed in -1 second. And for the survey conducting and infographic rendering part we are expecting to have 80% of transactions in -3 seconds since it needs a bigger time from the server due to massive information transacted..

3.2.2.3. Security

In order to increase the platform security, it will be accessed through HTTPS, which offers an encrypted communication protocol using Transport Layer Security (TLS). Every password will be encrypted in our database through the password_hash() function in PHP since it uses a strong one-way hashing algorithm. Since the MH web application will be coded in backend with PHP our main security principle and practice will be “Filter Input & Escape Output” in order to eliminate every possible way that threatens our system security.

In order to be authenticated and logged in to the system, every user must provide their email and password. Once a user logs in, a session is created for that user. The session created in PHP will store the data on the server and not on the user’s device. The user will be identified through its session ID (SID). This SID will identify him while linking it throughout all the navigation to our system. The session is destroyed as soon as the user logs out.

A manual verification & authorization will be placed by the platform administrator for two types of users: business & psychologist, in order to increase the reliability of our systems. The system will use a profile level checker in order so each user when enters his credentials it’s going to land on the appropriate dashboard.

3.2.2.4. Data Management and Privacy Policy

All the user personal data including documentation uploaded in the system must be collected with their consent. They will have to check and comply with the Privacy & Policy statement when they register in the platform.

The MH platform does not take responsibility and leaves it in the hands of the user for any information they provide in our system (text, image & documentation) that complies with various regulations and copyrights.

Users have to contact us directly if they want to delete their account and remove all their data from the system in order to conform to GDPR rules.

3.2.2.5. Ethical Requirements

The users' confidentiality and anonymity will be keep in compliance with psychological ethical laws. Confidentiality is referred to as the modification of any PII provided by the users from their data. Anonymity, on the other hand, refers to data collection without obtaining any PII. In most quantitative research, anonymity is preserved, whereas, in qualitative studies, confidentiality is maintained.

The system proposed collects information from participants in both circumstances, and this information becomes the data to be evaluated. People's actions and experiences, rather than an exposé about individuals, are of tremendous interest to social scientists. Researchers in the case of the system, psychologists) are required to respect their subjects, but they are less interested in reporting on the behavior of a specific individual.

In the "education" environment, since there will be engaged students aged (12 – 18 years old) and they do not are legaly accepted to open an email in order to register to our system, I found a way in order so they could be registered and in the same time have access on the studies/surveys offered in their educational institution by its psychologist. The educational psychologist will be responsible to enter e list (register) of students' name, part of the

educational institute he is associated in. He will also put the emails of the parents or legal representative. When the professor creates a study/survey he needs to have acess to the school computer lab so he cn inaite students and start a live session. The lise session starts by the psychologist selecting the student and also the study/survey and wait for them to answer. Parents get insight from the class/school questions not directly from their child, as we strive to keep our informations confidential and also anynymous.

3.3. Software Design

Software design is a technique that intends to collect clients' requests and convert them into a proper framework. Programmers use this format to design, write code, and create and deploy a software product.

In addition, the first step of the SDLC (Software Development Life Cycle) is software design. It shifts attention to the solution domain. The system is considered a collection of components with well-defined bounds and behaviors [26].

3.3.1. BPMN

Enterprises will be able to represent their inner business processes using a standardized form known as Business Process Model and Notation (BPMN). Using this standard companies will be able to convey business logic procedures uniformly. Additionally, the graphical notation that BPMN uses will make the operations and economic transactions more understandable. BPMN helps the engineers to define requirements and also assits them to find the innovative path of their solution [27].

Find a psychologist, Business POV – BPMN

The design in Figure. 3 is described in a detailed view, using the BPMN notation, the action “find a psychologist”. Action is designed from a business's POV. The diagram describes the businesses which initialize the system by checking a psychologist from their list and then they have the opportunity to send a message directly to them or fill and send a contract to them. Depending on business decisions users can receive and send back messages or can also approve or reject any contract offered by any business. In cases where the contract is accepted by both parties, the payment is done by the business for as many accounts he needs for his employees. System than generates access for each of the account businesses paid. A psychologist is connected with these accounts directly and can execute its privileges.

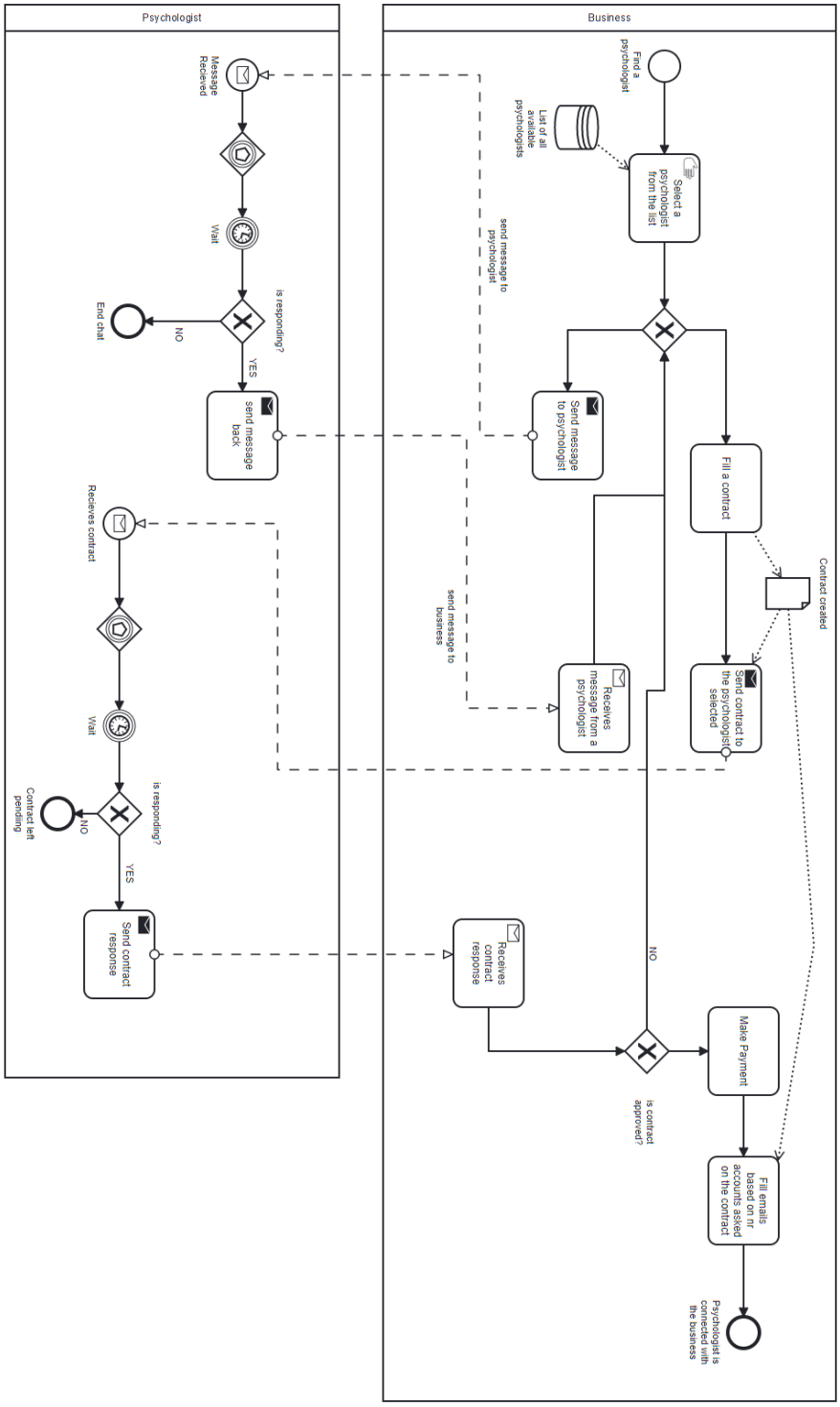

Figure 3. BPMN which demonstrates the action of business finding a psychologist (sealing a contract)

3.3.2 Behavioral Diagrams

The behavioral view emphasizes the system's dynamic activity by displaying object partnerships and changes in their internal states [28].

3.3.2.1 Use Case Diagram

In the Unified Modeling Language (UML), a use case diagram can describe the characteristics of your system's users (also referred as actors) and their interactions with the system [29].

To describe the details of the Mental Health platform proposed, I have designed all the 3 environments of the platform as well as one for the administrator (person responsible to maintain and supervise the platform).

General User – Use case

The diagram designed in Figure. 4 represents the interaction of “general users” with the system and other actors. It gives also a view of how a psychologist behaves in this environment and what are each of the actor’s privileges. As seen below, it shows that different from a “general user”, a psychologist goes through registration with a verification case. Both actors can log in, log out, and also view and edit their respective profiles. Furthermore, a psychologist has the privilege to create a study/survey and send it to all “general users” to complete it/ Psychologist can finalize the study/survey by giving conclusions. On the other hand, “general users” have the right to complete studies/surveys and get insights from them.

Figure 4. Use case for “General User”

Business – Use case

The diagram designed in Figure. 5 represents the “business” environment. It describes the interaction of an “employee” with the system and other actors like businesses and psychologists. It gives a detailed view of how a psychologist behaves in the business environment and what is it extra privileges in this area As seen below, it shows that different from “employee”, both business and psychologists go through the registration with verification case. All three actors can log in, log out and also view and edit their respective profiles. Moreover, the psychologist has the privilege to chat directly with businesses and to get, accept and reject contracts. Also, psychologists can create a study/survey and send it to all or individual “employees” to complete it. A psychologist can finalize the study/survey by giving conclusions and also communicate in private with the “employees”. On the other hand, “general users” have the right to complete studies/surveys and get insights from them and also contact the psychologist associated with the business where the employeed is.

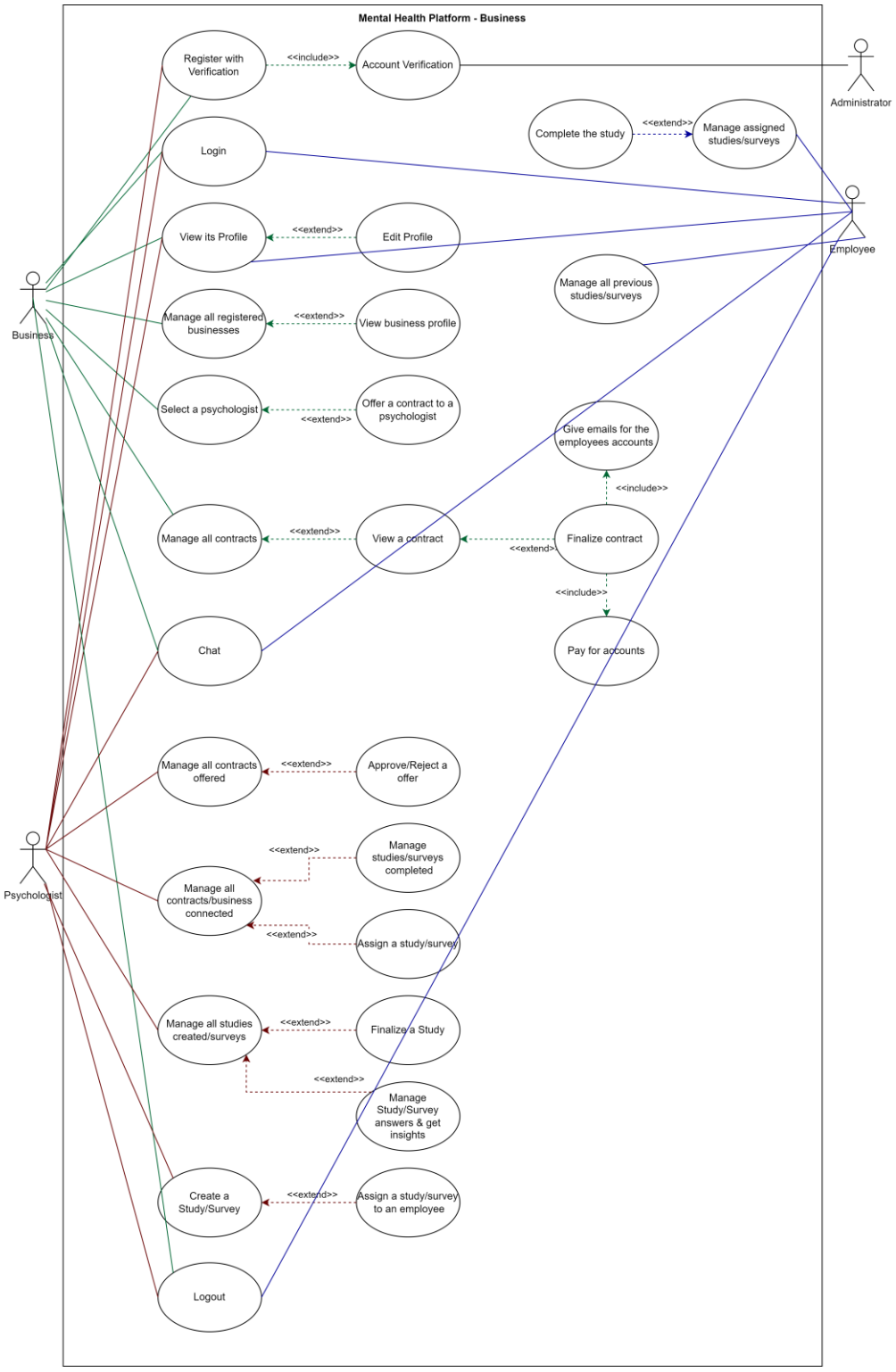

Figure 5. Use case for “Bussiness”

Education – Use Case

The use case in Figure. 6 gives a detailed view of how the “education” environment works. It shows how the main actors’ “parents” and “psychologists” interact with each other. This use case describes the implementation of the proposed mental health platform in the education institutions (12-18 years old) and how the students and psychologists can be integrated into a system. Parents are given access to this environment if the school psychologist has put his email to one of the student’s representatives (parent or another legal representative). Psychologists have the privilege to access this environment by entering an activation code given by the school in which they operate. Psychologists can add students to the system. Moreover, they can create studies/surveys and start sessions online so the students can complete them in real-time. School psychologists are the only one which can initialize a chat with the parents and get insights from the students' responses.

Figure 6. Use case for “Education”

Administrator – Use case

The diagram displayed in Figure. 7 gives a detailed view of all the tasks that can be held by an administrator (users responsible for maintenance and coordination of the MH platform). It shows that the administrator can view and delete the profile of every account joined. Furthermore, they can access and delete the studies/surveys created in the system. The administrator will be the person with the privilege to create an educational institution and give it an activation code to operate.

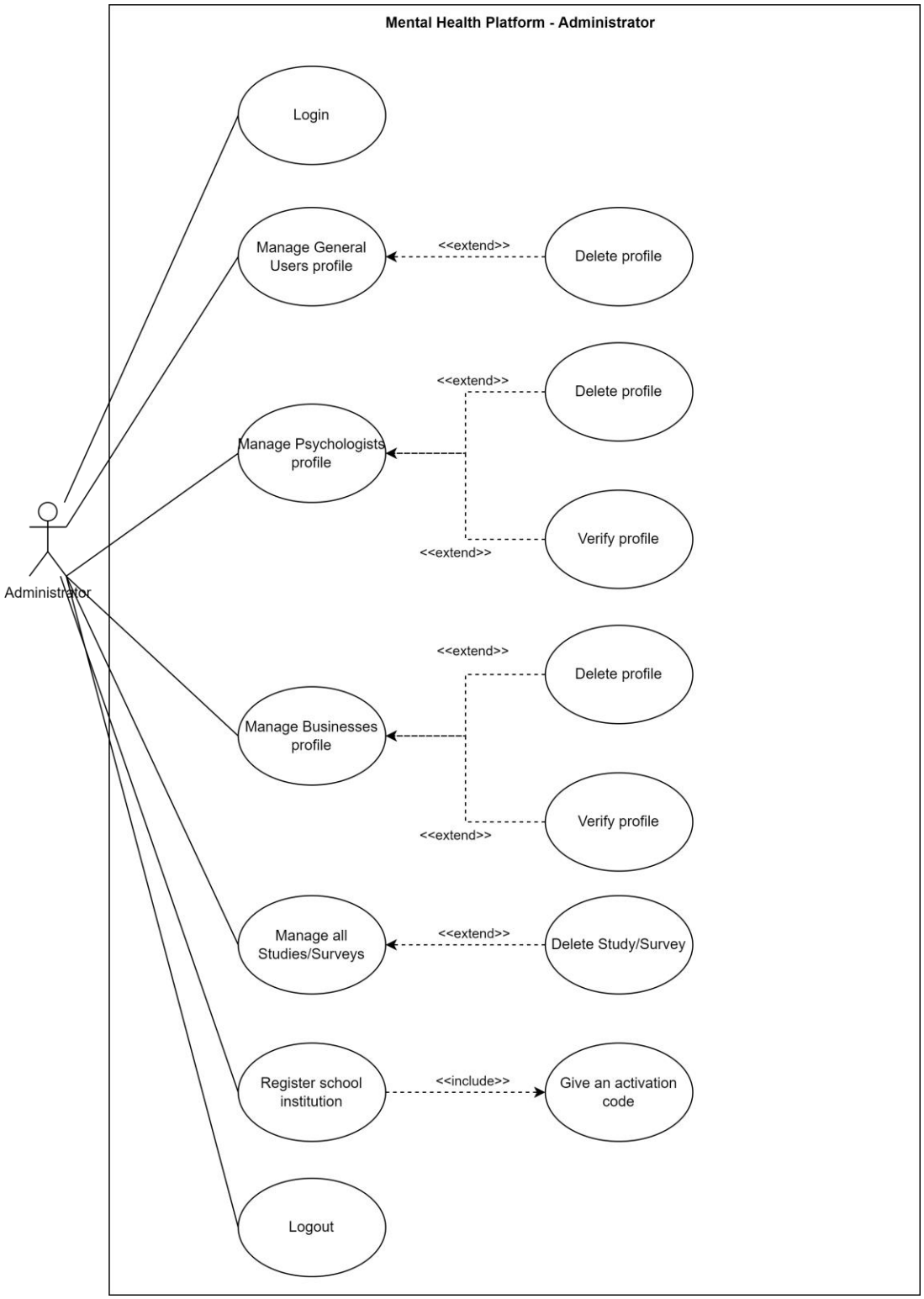

Figure 7. Use case for “Administrator”

3.3.1.3. Sequence Diagram

The UML Sequence Diagram demonstrates how operations are execute. They show the interaction between objects in a collaborative setting. Sequence Diagrams are time-oriented, with the vertical axis representing time and the messages visually depicting the order of interaction [28].

Login – Sequence diagram

The sequence diagram designed in Figure. 8 describes in a detailed view the login action for any user. This is the action performed for authenticating any user who tries to enter the system. It starts with the user filling out the login form with its credentials. Then system gets the password and passes it to the system to encrypt and also requests to know the user profile so it can match the appropriate dashboard. After is madding connection in the database and profile is matched and the password is encrypted, the authentication of the credentials is made. An “authenticate” alternative separates the responses in case of a login failure. If user credentials are successful, the profile is authenticated and the user receives the appropriate dashboard.

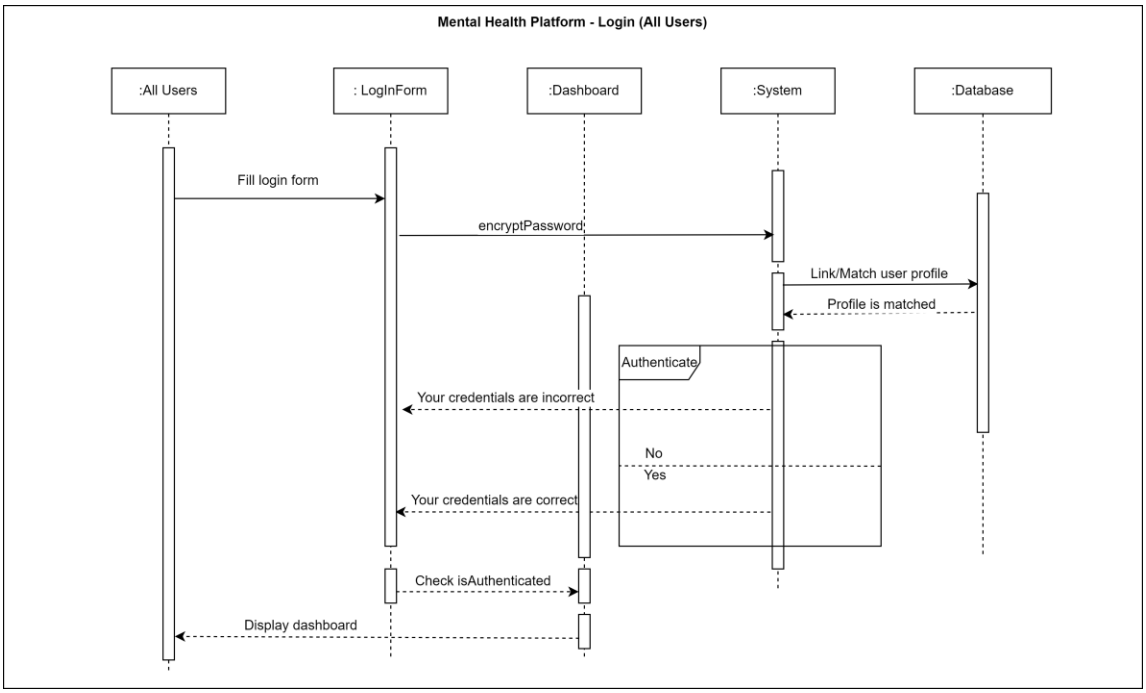

Figure 8. Sequence diagram for Login activity for all users

Account verification – Sequence diagram

The sequence diagram designed and described in Figure. 9 demonstrates the registration part of two actors, psychologist and business. The registration part of these two actors is different from the others as it has one extra verification step which is done manually by the administrator. It start by the psychologist or business entering data to the respective registration form. The data are saved in database. To verify the administrator requires from database the data which were recently saved. After getting data, admin use them and verify them. An alternative is used to send the appropriate feedback. In case if the account is verified, the database is updated with new information.

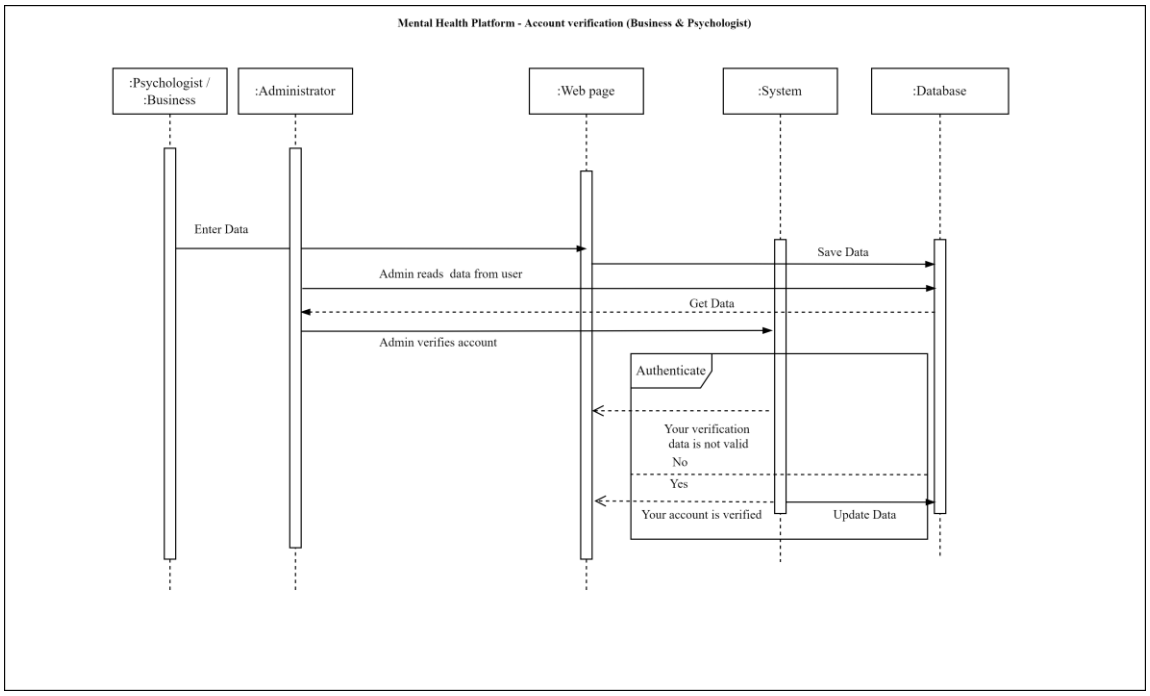

Figure 9. Sequence diagram for account verification for Psychologist and Business users

3.3.1.4. Collaboration Diagram

Collaboration is a collection of named actions and systems that are linked together. They collaborate to complete any job. They can show how objects communicate to carry out a certain use case's or an aspect of a use case's actions. Collaboration diagrams can be used by designers to illustrate and define the responsibilities of objects in a use case's specific sequence of events [30].

Login – Collaboration diagram

The collaboration diagram designed in Figure. 10 defines the responsibility of each object to perform the login action to authenticate each user. It is a translation of from sequence diagram (Figure. 8) in the collaboration diagram (Figure. 10).

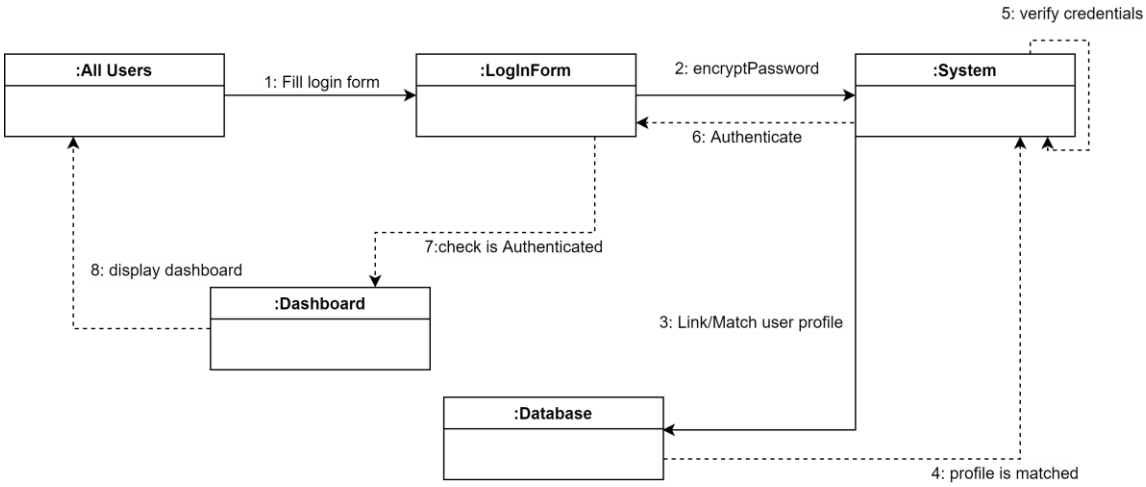

Figure 10. Collaboration diagram for Login activity for all users

Account authentication and verification – Collaboration diagram

The collaboration diagram designed in Figure. 11 defines the responsibility of each object to perform the login action to authenticate (register) each user onto the system. The sequence diagram in (Figure. 9) is translated into collaboration diagram (Figure. 11).

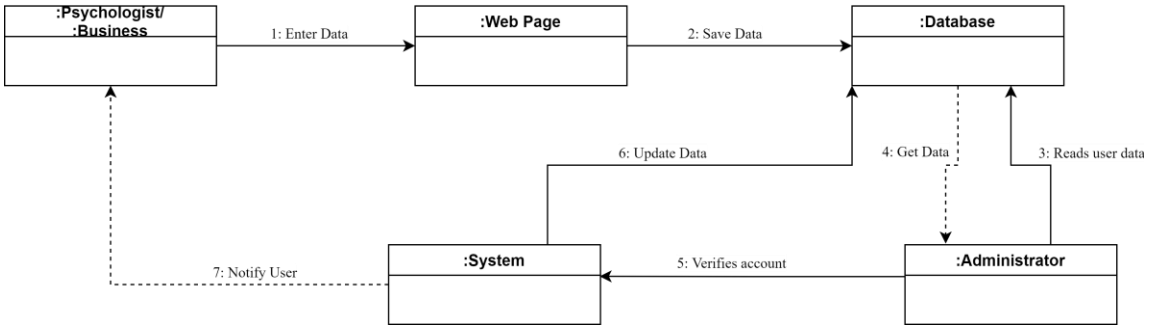

Figure 11. Collaboration diagram for account authentication and verification for Psychologist and Business users

3.3.2. Structural Diagrams

3.3.2.1. Class Diagram

Systems's class diagram.

The class diagram is part of UML family diagrams and is used for building and visualizing object-oriented systems. The system's class diagram designed in Figure. 12 is a form of a static structure diagram that depicts the structure of a system. It serves as a graphical notation to display the classes of the system and its attributes, methods, connections among different objects, and their multiplicities.

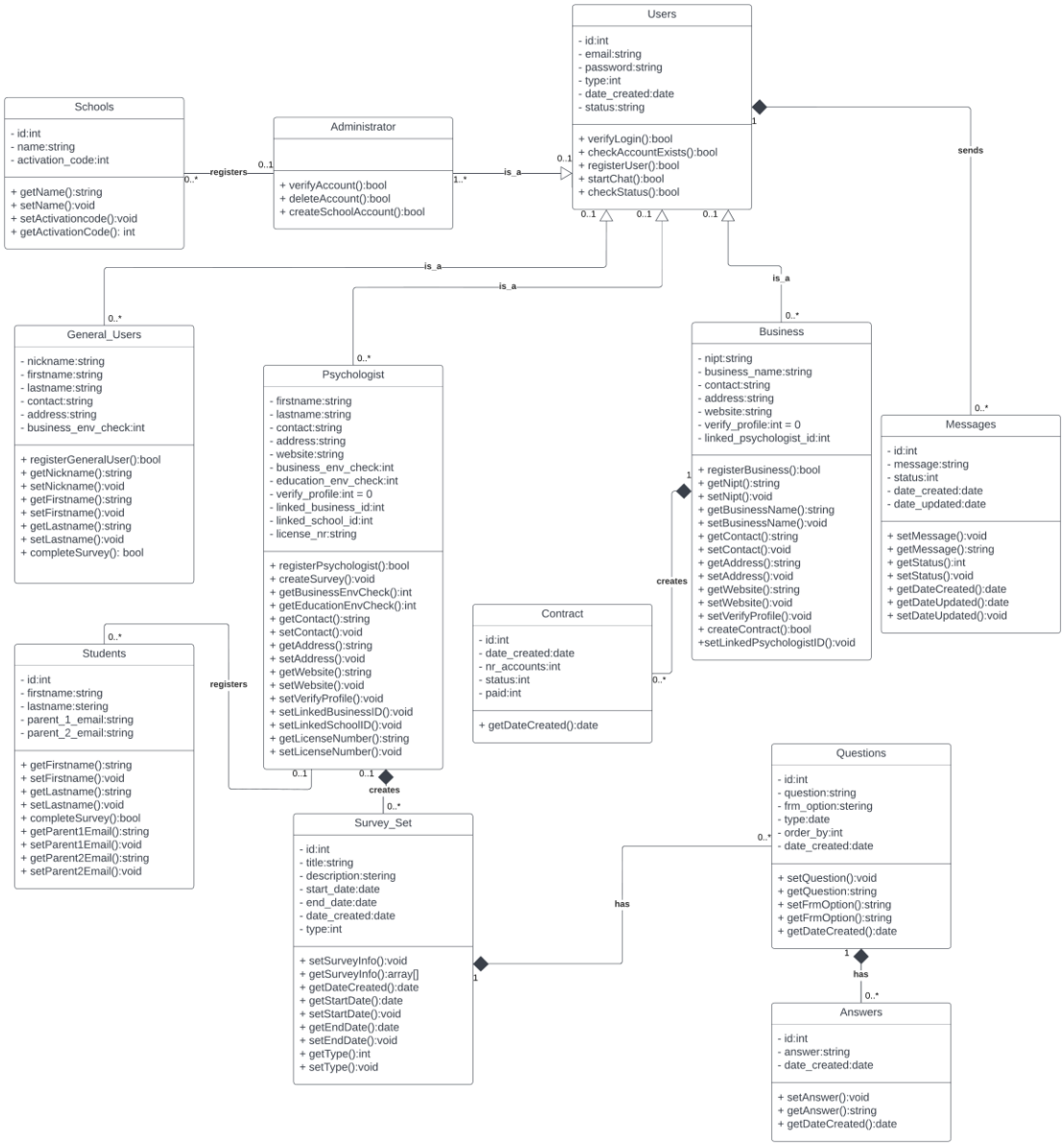

Figure 12. System's class diagram

3.3.2.2. Component Diagram

A component diagram illustrates the organization and wiring of physical components in a system. These types of diagrams are widely used to illustrate implementation details and

make sure that projected development encompasses all areas of the system's core functions [31].

System’s component diagram.

The component diagram designed in Figure. 13 shows how the physical component of the system proposed is organized. It shows how the MVC architectural pattern is going to be implemented and what are the assets and shared components to build the system. On top of the model stays the Database. The controller CRUD operation is defined and also how the management processes are organized inside the View component. In the end, it emphasizes the server and web browser component connection with the MVC.

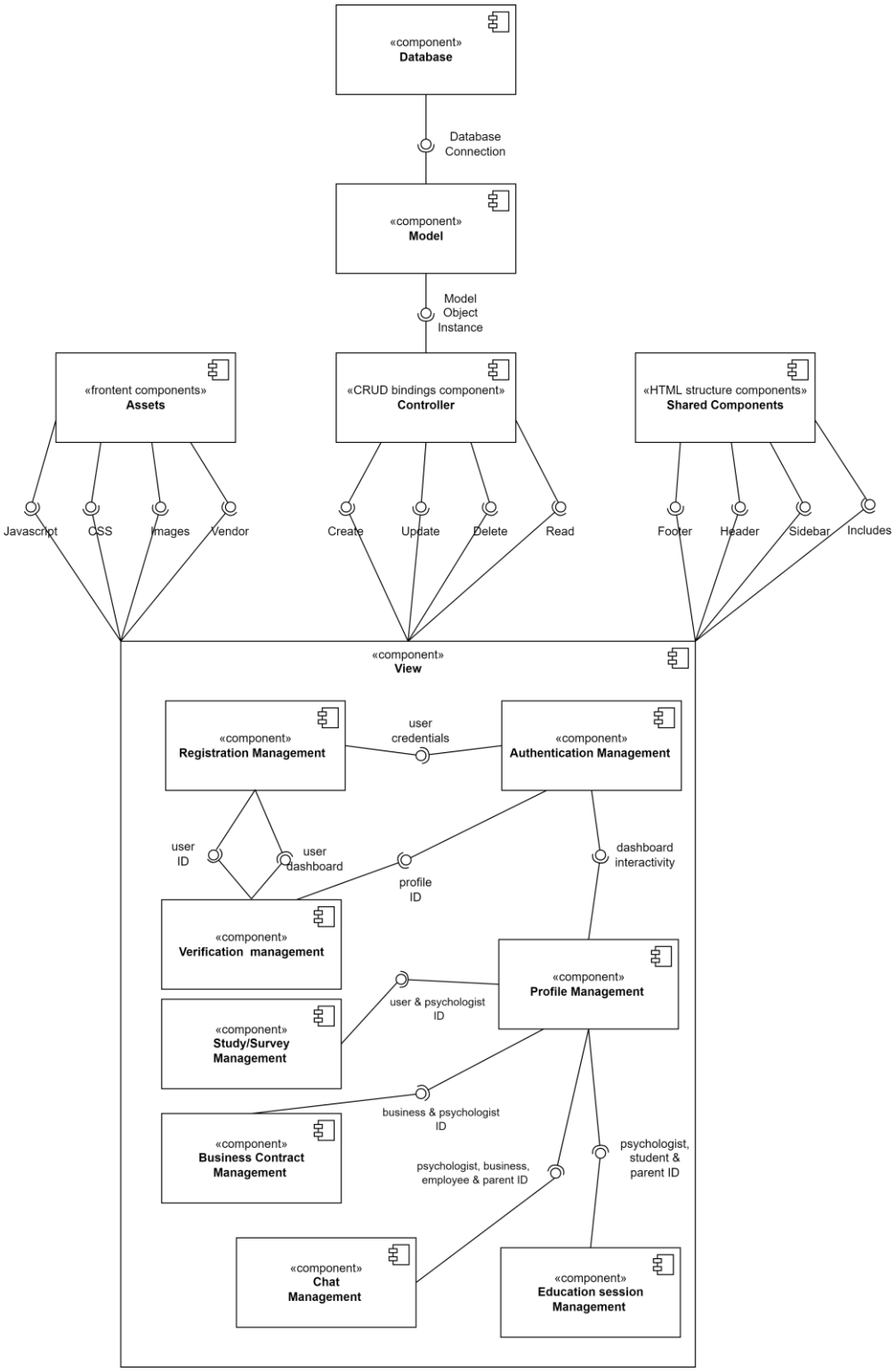

Figure 13. System's component diagram

3.3.2.3. Deployment Diagram

Deployment diagrams are used to visualize a system's hardware processors, nodes, and devices, as well as the communication links between them and the software files that are placed on that hardware [32].

System’s deployment diagram

Figure. 14 illustrates the system’s deployment diagram. The platform proposed would be a web application and as it will run through the network, the web browser of the device when it will run will communicate through an HTTPS connection. Also, a connection TCP/IP will connect the server and execution environment and will handle user requests and will generate responses. For testing purposes, it will be run on an Apache server which will be connected through TCP/IP with the database running in a MySQL server. The session, data, cookies, and GUI will be inside the web application artifact.

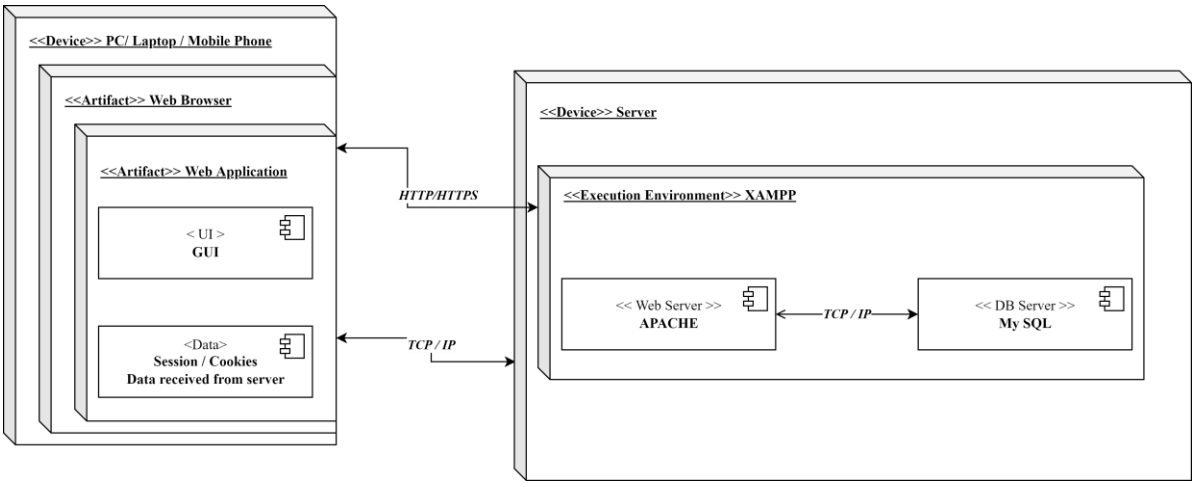

Figure 14. System’s deployment diagram

CHAPTER 4

IMPLEMENTATION

The Mental Health platform proposed is a web-based application running on top of a web server that is accessible through any web browser.

4.1 Technologies Used

4.1.1. Front-end (Client-side development)

The client-side of this web application is built using these scripting and stylesheet languages and technologies:

1. HTML5 – a markup language used to structure, organize and display material on the WWW. It is used to build the front end's framework (backbone).

2. CSS – a styling language, used for designing the pages, layout, font, and colors.

3. JavaScript – a high-level, dynamic, reactive and interpreted programming language that makes the pages more interactive.

Libraries:

1. Bootstrap – the most popular HTML, CSS, and JavasScript framework for developing responsive web applications.

2. jQuery – a JavaScript library that simplifies JavaScript usage concerning front-end tasks. I have utilized the following features from the jQuery library:

- HTML/DOM manipulation

- CSS manipulation
- Event handling
- Effects and animations
- AJAX – makes HTTP requests to the server without reloading the page, receives, and works with data coming directly from the server. JSON objects are used to exchange data with the server.

4.1.2. Back-end (Server-side development)

The back-end of this web application is implemented using vanilla PHP: a fast, flexible, and pragmatic general-purpose scripting language suited to web development. XAMPP is used as the most popular PHP development environment (testing and development purposes not for production). As part of XAMPP, Apache HTTP Server is used. Apache is an HTTP cross-platform web server, used worldwide for delivering web content. The remote server of Apache delivers the requested files, images, and other documents to the user.

4.1.3. Database

The database used for this web application is MySQL, a relational database management system (more specifically the open-source MariaDB as part of XAMPP, a fork of MySQL). Using standard structured query language, being fast, reliable, compliable on several platforms, and easy to work with.

4.1.4. MVC architecture

MVC is used as an architectural pattern to implement the MH platform:

Model: the model classes have the single responsibility of communicating directly with the database. Inside each model, the respective functions that prepare the query statements are constructed. These functions return the results of database operations to the controllers. For example, a user object will retrieve a study/survey from the database and will manipulate its questions by giving answers and updating it back to the database.

View: the views from the front-end of the web applications contains all the page designs and respective dashboards. These are basic HTML files with UI components, which incorporate JS for an interactive experience. In this view, different UI components fire actions for the controllers to handle.

Controller: the controller acts as an interface between the Model and View components to process all the incoming requests, perform business logic, and manipulate data by using the Model and render the output into the views so it can be responded to user requests.

CHAPTER 5

CONCLUSION

Being part of our psychological, emotional, and social well-being, mental health is crucial at all life stages. It impacts directly the way we feel, think and act. With the fast emerging of technology, there have been designed and implemented several web and mobile applications which tend to increase people's attention towards mental health issues. A new platform approach is proposed in this research bringing a novel contribution to the currently developed market.

This research aims to analyze, design, and implement a digital mental health platform focusing on raising people's awareness and increasing their attention toward mental health care. The conducted research demonstrates through design schemas and software implementation the highly impactful role of the psychologist as a main leading influential in the proposed mental health platform. The platform can be integrated into three different environments; General user, Education, and Bussiness.

The "General User" environment is implemented and ready to be used. A psychologist can register, verify in the platform, and can create surveys/studies and spread them on the platform. Everyone who wants to be part of the study can register and complete them. Each of them will receive in real-time the results of the study displayed in different infographic formats. The platform is secured and preserves the users' anonymity and confidentiality by following national laws in Albania and also international laws (GDPR).

The "Education" platform is also already implemented. Schools can register by contacting the administrator directly. The administrator of the platform registers the school contacted and assigns to it an activation code which will be passed to the school's psychologist to access the education section. Students are registered by the school's psychologists and sessions can be opened by them and invite students to complete their study/surveys.

In the “Business” environment there is possible for every business to register and get verified. Businesses can access the profile of all available psychologists on the platform and give them a contract to hire the psychologists for their employees.

The field of business is a broad area that exceeds the boundaries of this study. This research proposes through scenarios and design schemas the interaction of a psychologist and a business, and how businesses can be in contact with a psychologist for their employees, but there is needed a deeper market and economic research on how businesses and psychologists tend to approach a deal. Detailed analysis of the current business market and how the relationship between psychologists and business is being developed nowadays is required. After getting these research results, we can redefine the requirements and come up with a more complete approach. Intentionally due to these limitations, the “Business” environment is not being fully implemented on the platform and is being held pending due to future work needed.

Lastly, considering the high speed of technology, there is work to be performed in the future to improve this platform and other approaches currently on the market. As the platform proposed displays only one type of infographic, there can insert many other types of infographics based on survey/study question types. It will increase drastically the user interface and experience on the platform. Furthermore, the “Bussiness” environment can be redesigned after future studies are held concerning the relationship between psychologists and businesses. Using the approaches currently available in the market, they only raise awareness among people and give them suggestions to improve their decision-making process. What will be the next step is to create and design implementations, which tend to prevent or even diagnose digitally and in real-time different mental health problems among humans. All in all, these approaches will affect drastically human life and will help us to have a better, safer, and peaceful environment.

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APPENDIX A

SYSTEMS SCREENSHOTS

Figure 15. Mental Health platform landing page

Figure 16. Mental Health platform Privacy and Policy page

Figure 17. Mental Health platform Terms and Conditions page

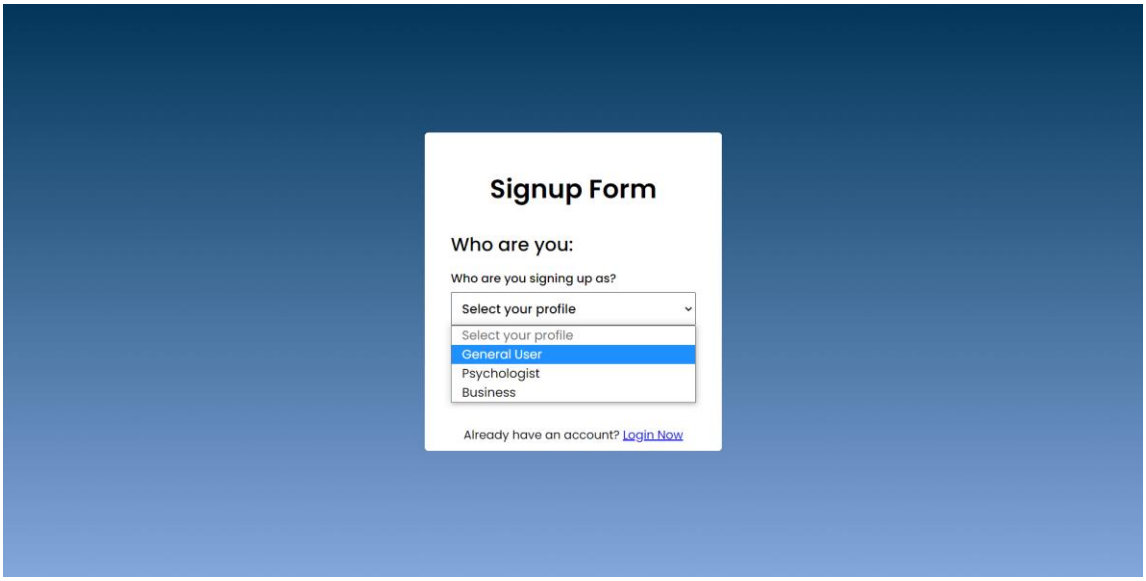

Figure 18. Mental Health platform SignUp page

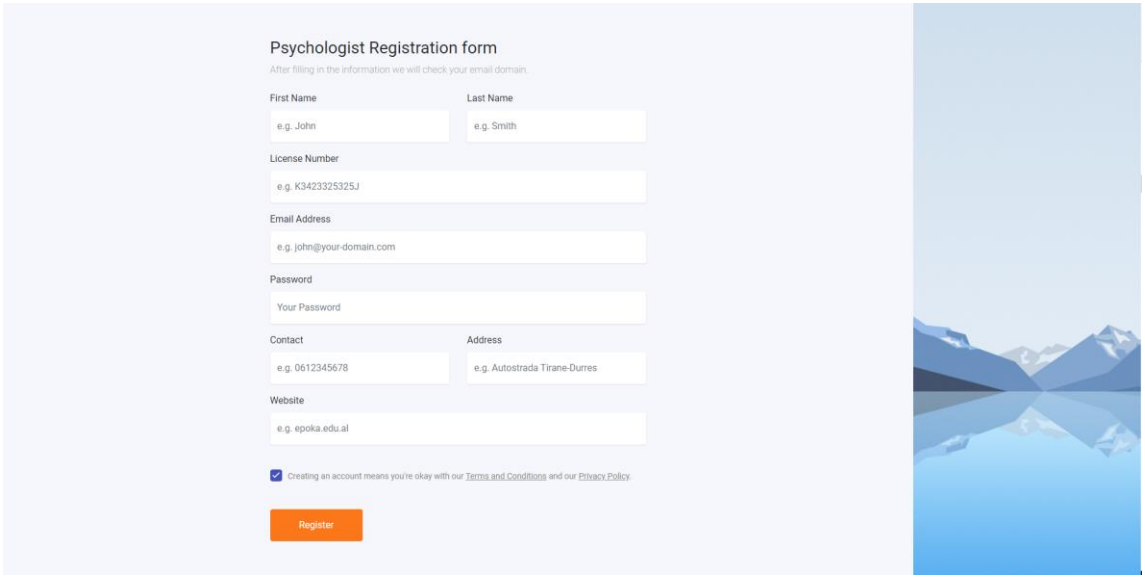

Figure 19. Mental Health platform psychologist registration form

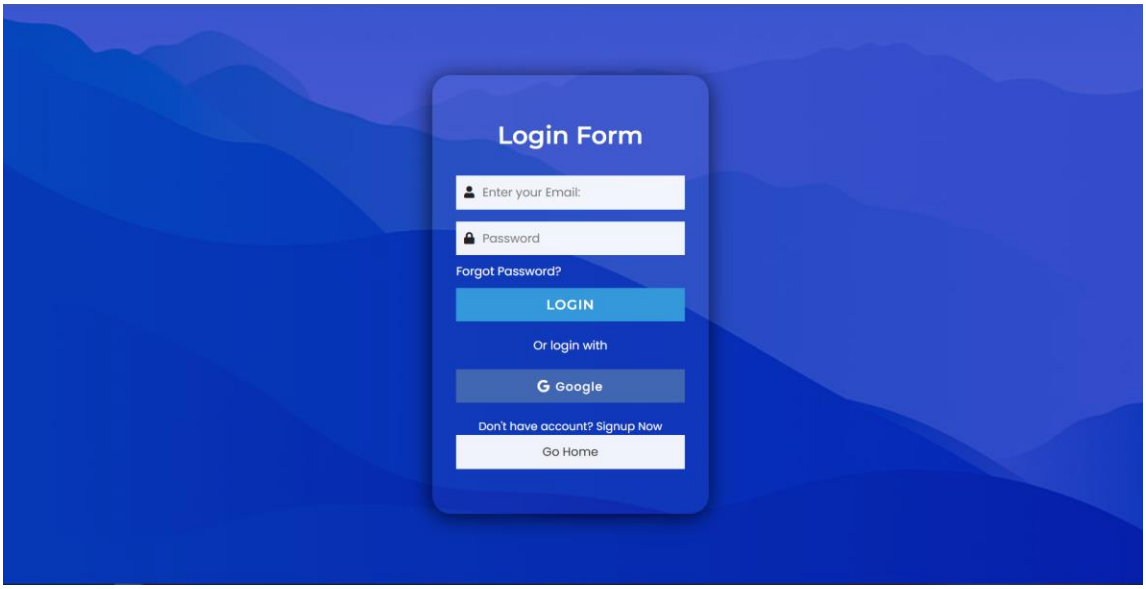

Figure 20. Mental Health platform Login page

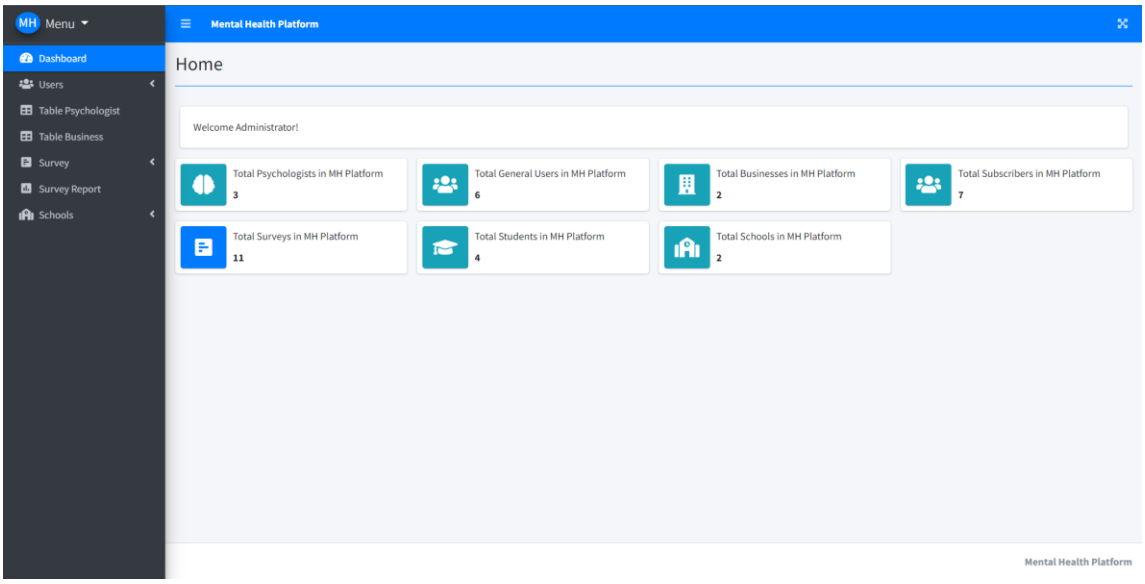

Figure 21. Mental Health platform Administrator – Dashboard page

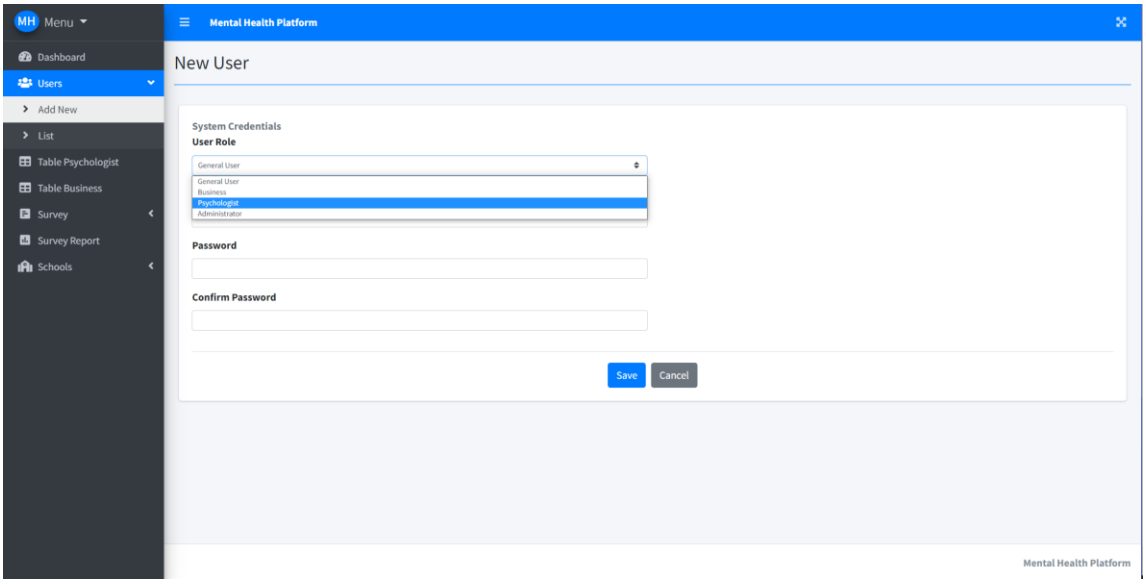

Figure 22. Mental Health platform Administrator – Add New User page

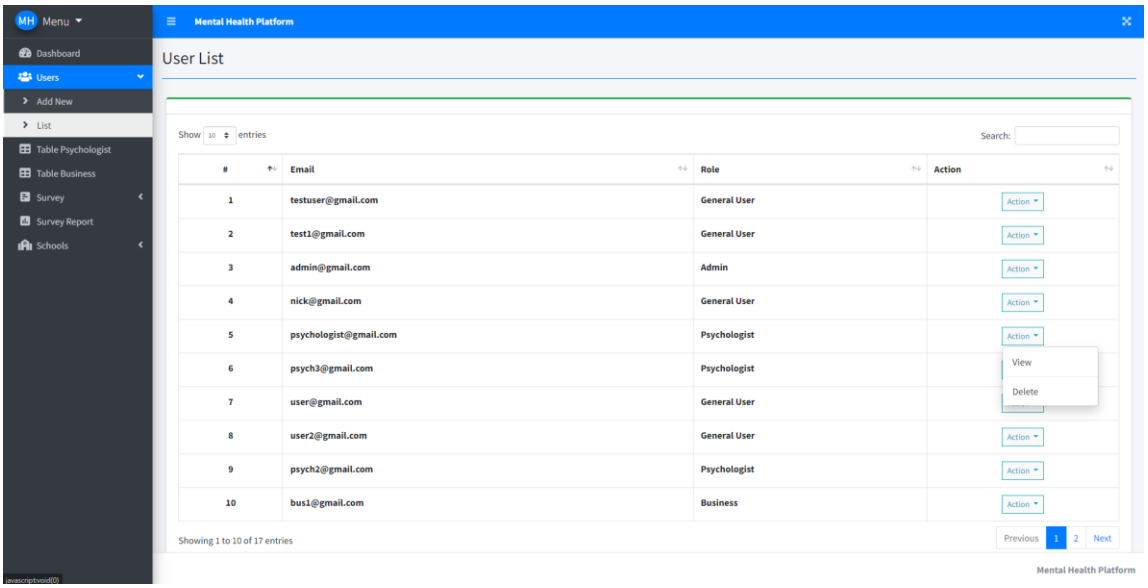

Figure 23. Mental Health platform Administrator – User List page

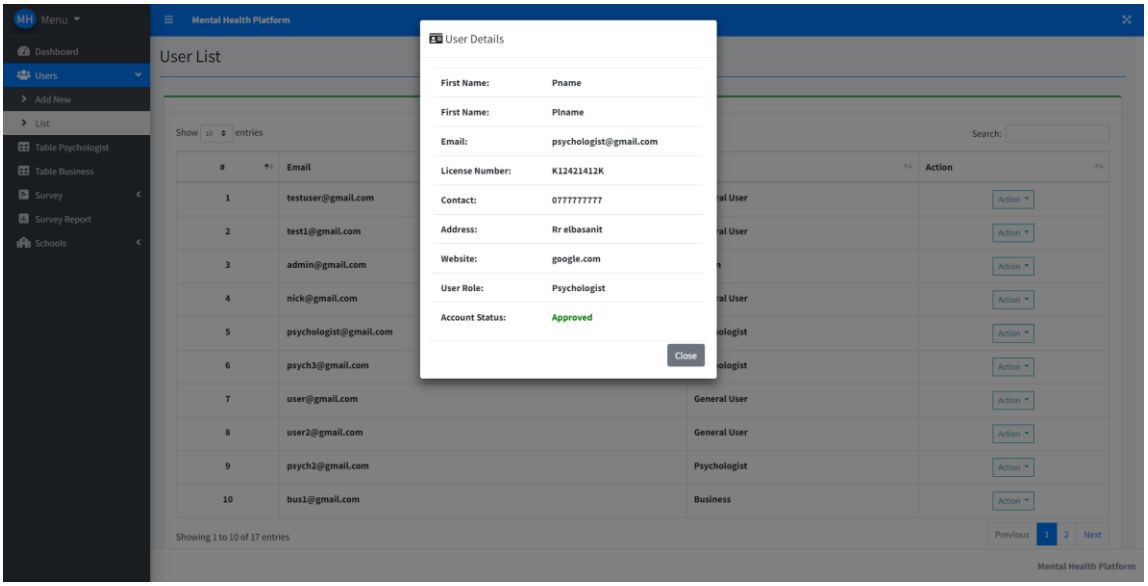

Figure 24. Mental Health platform Administrator – User Details page

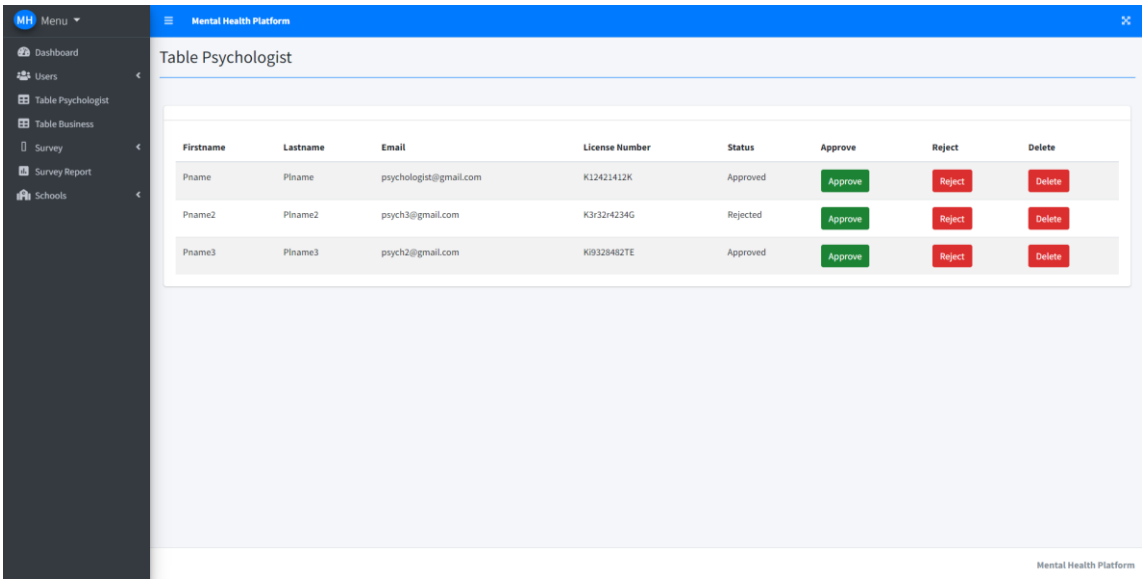

Figure 25. Mental Health platform Administrator – Manage psychologists' page

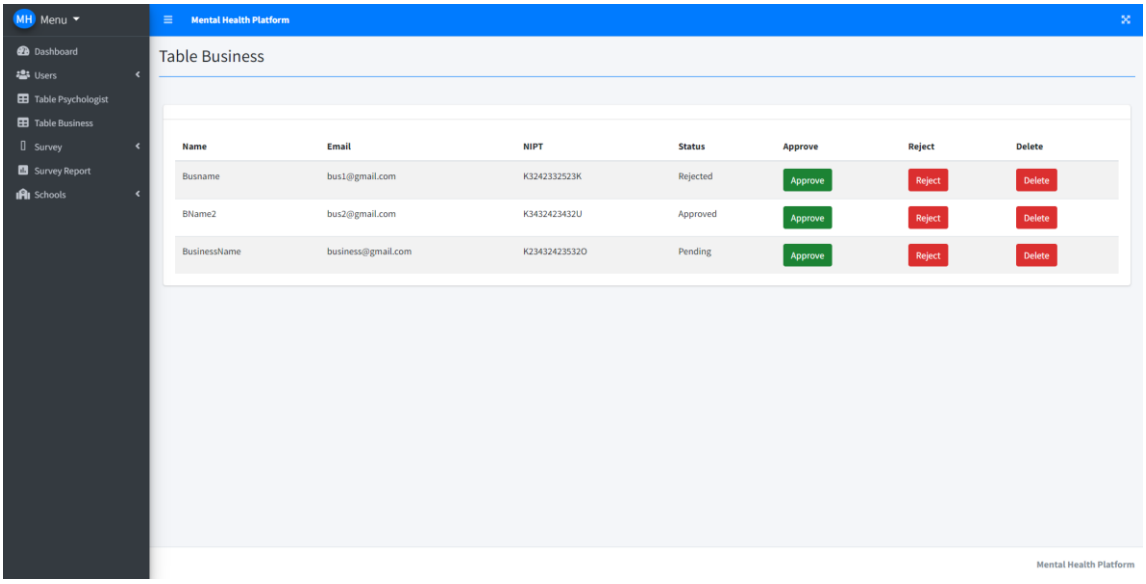

Figure 26. Mental Health platform Administrator – Manage businesses page

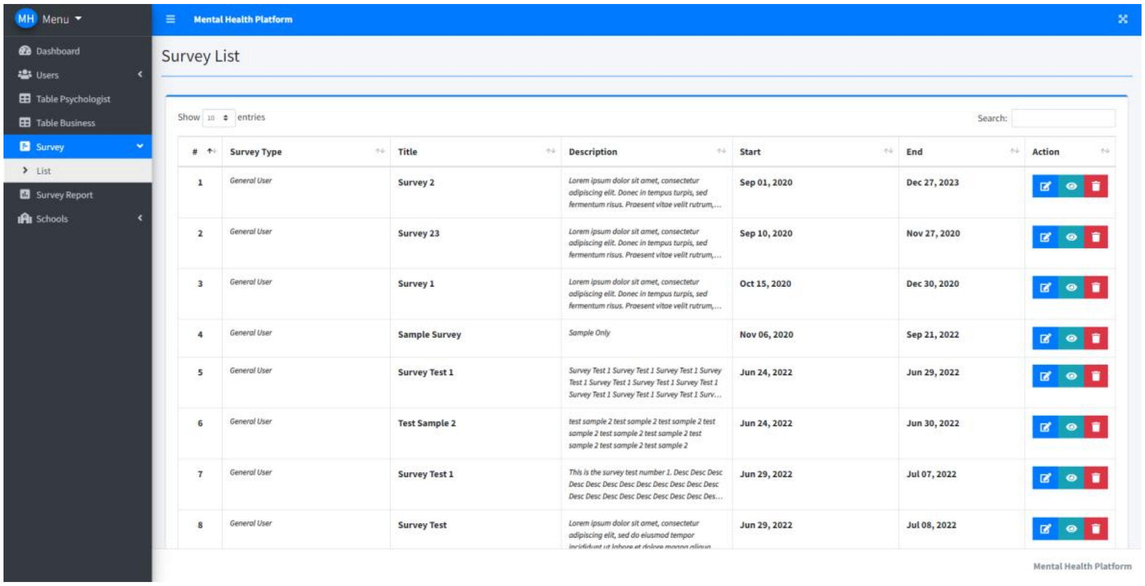

Figure 27. Mental Health platform Administrator – Manage surveys page

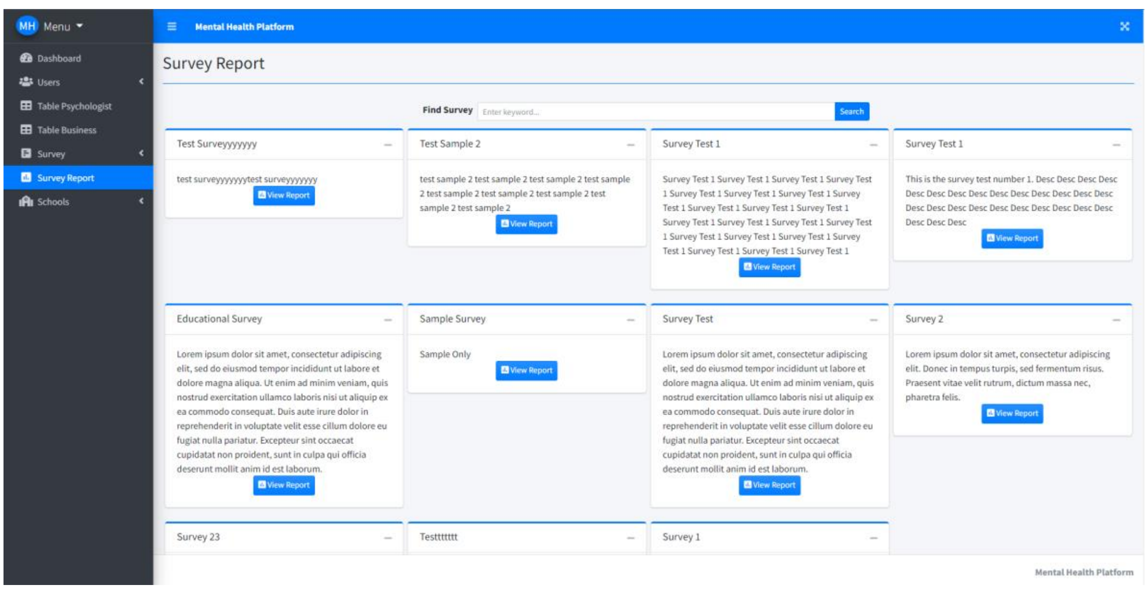

Figure 28. Mental Health platform Administrator – Survey report list page

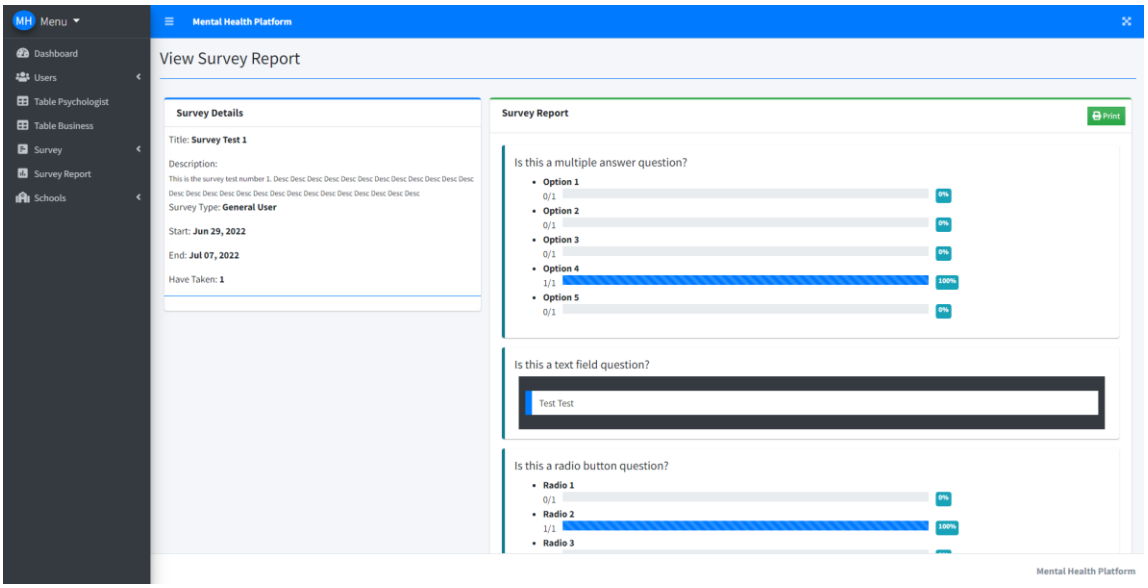

Figure 29. Mental Health platform Administrator – Survey report page

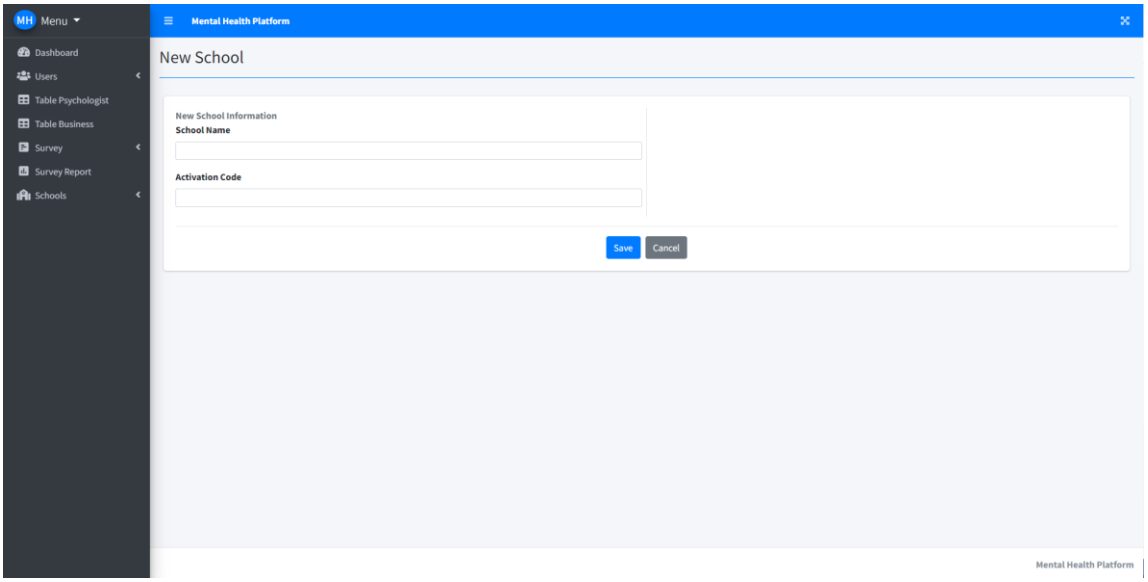

Figure 30. Mental Health platform Administrator – Add new school page

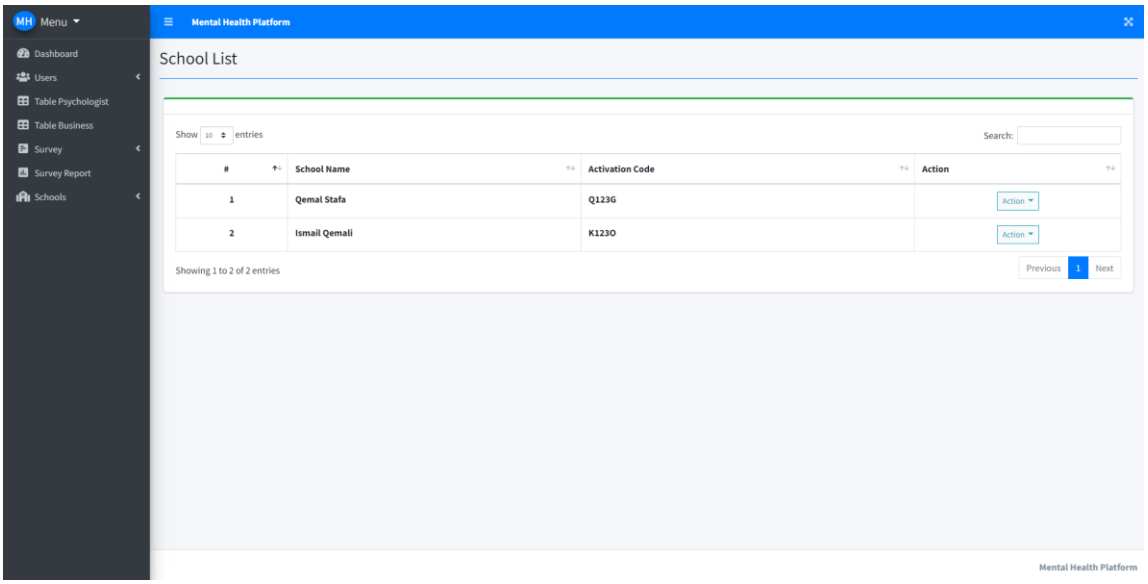

Figure 31. Mental Health platform Administrator – List of schools page

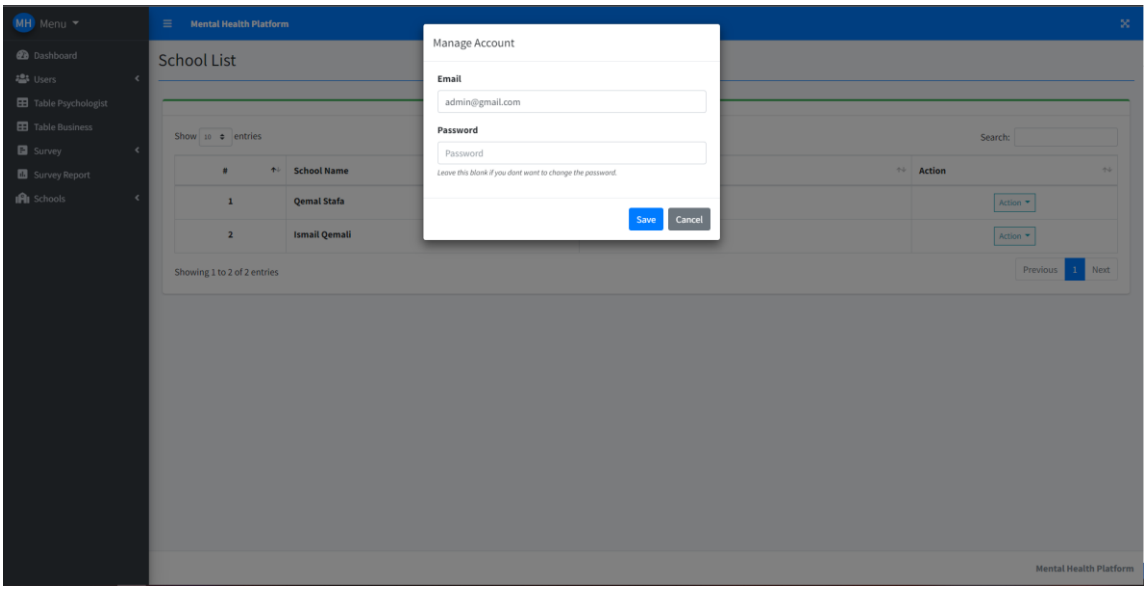

Figure 32. Mental Health platform Administrator – Manage Account page

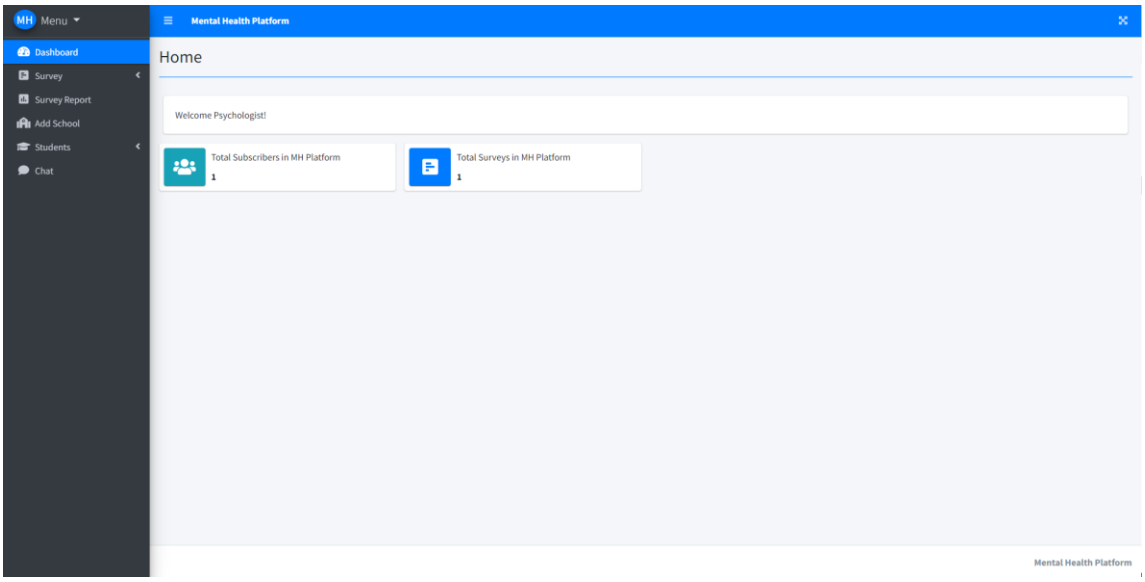

Figure 33. Mental Health platform Psychologist – Dashboard page

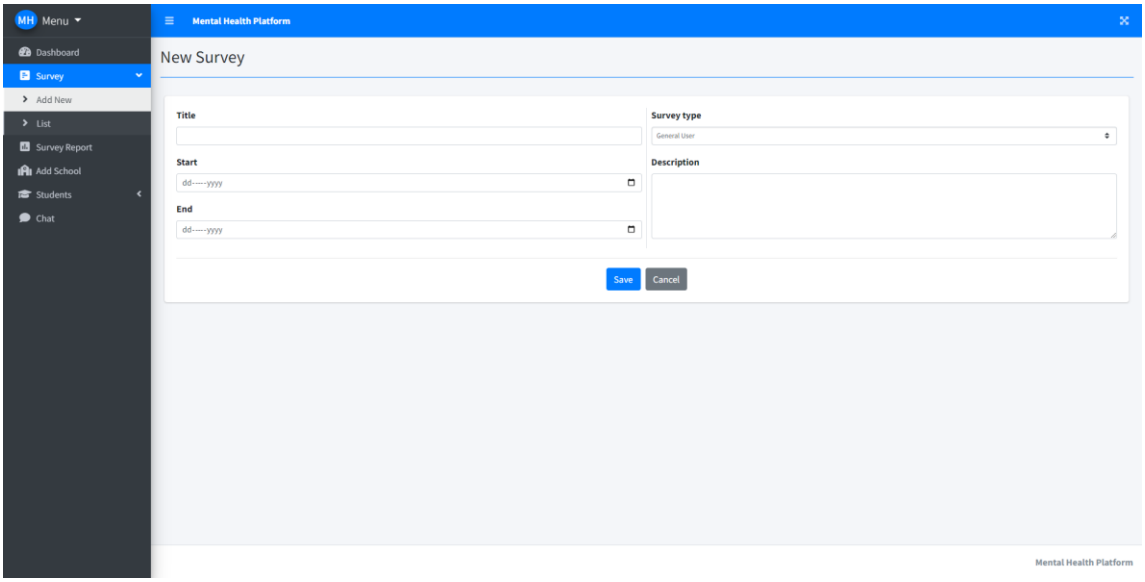

Figure 34. Mental Health platform Psychologist – Add new survey page

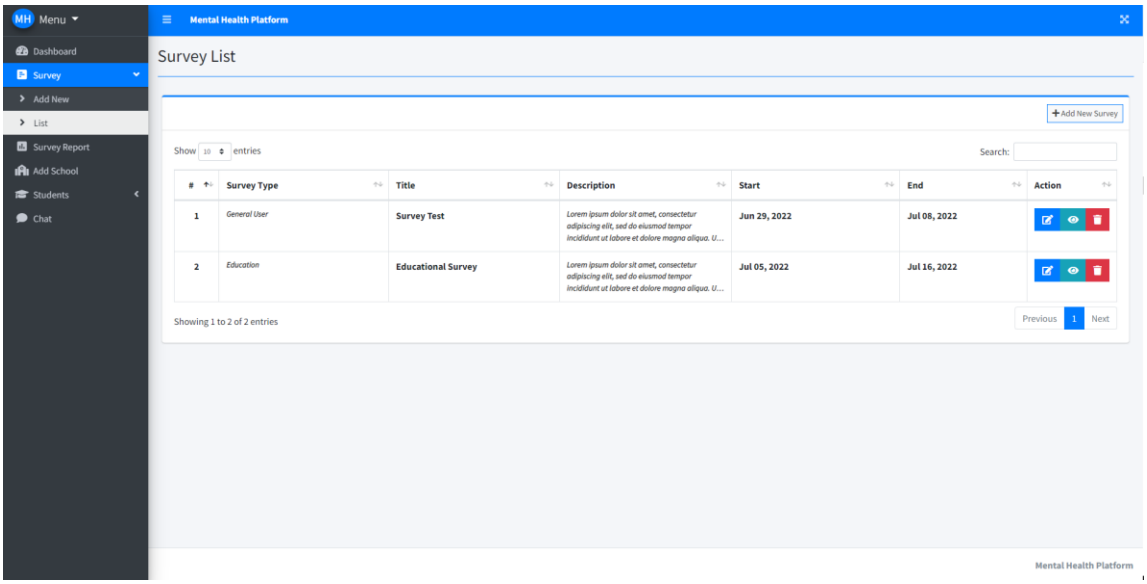

Figure 35. Mental Health platform Psychologist – Survey list page

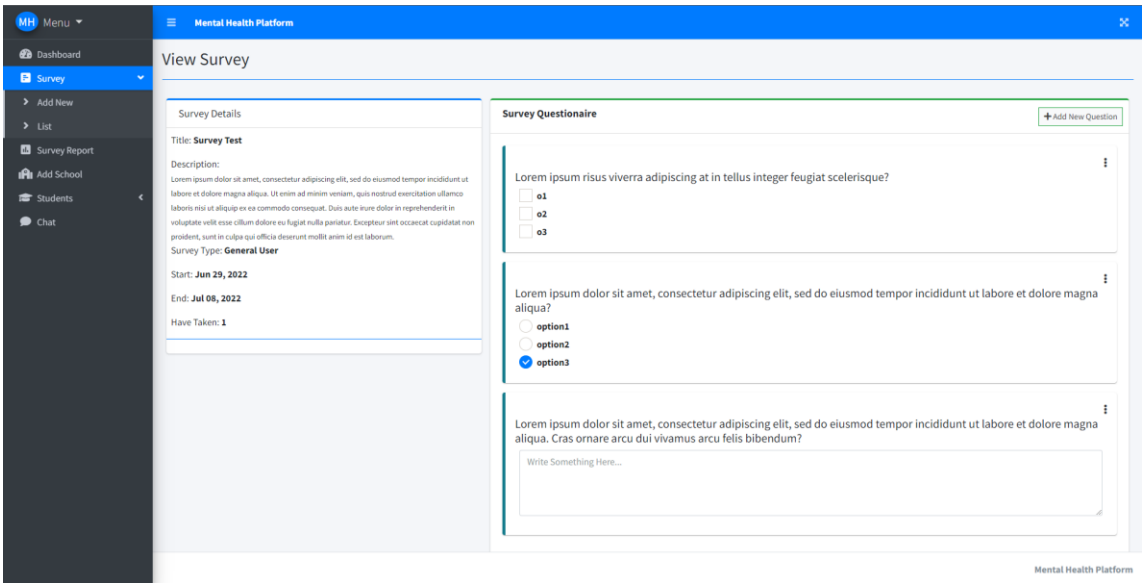

Figure 36. Mental Health platform Psychologist – View survey page

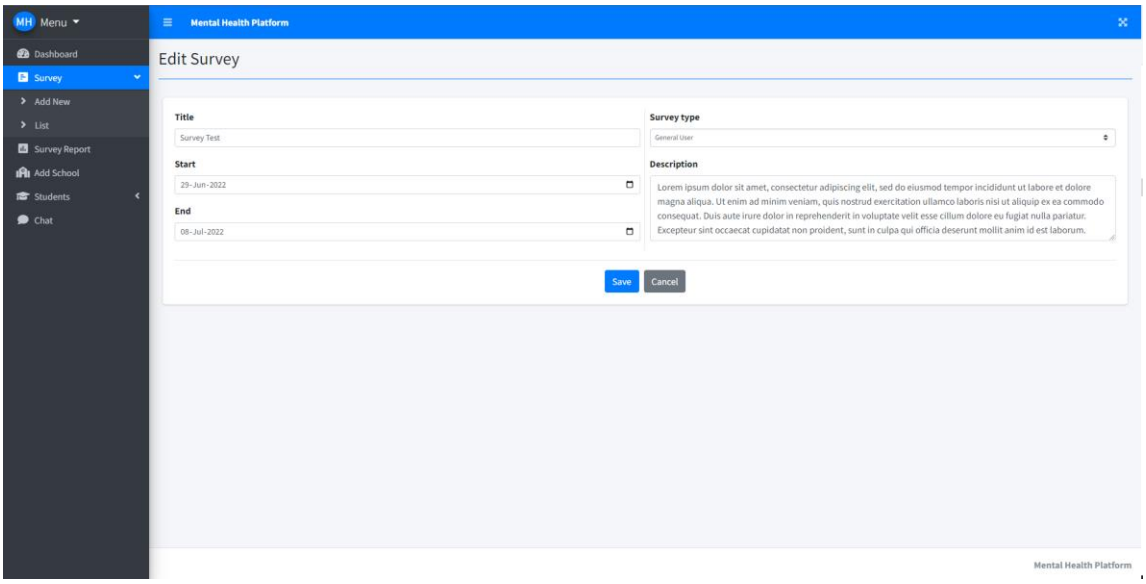

Figure 37. Mental Health platform Psychologist – Edit survey page

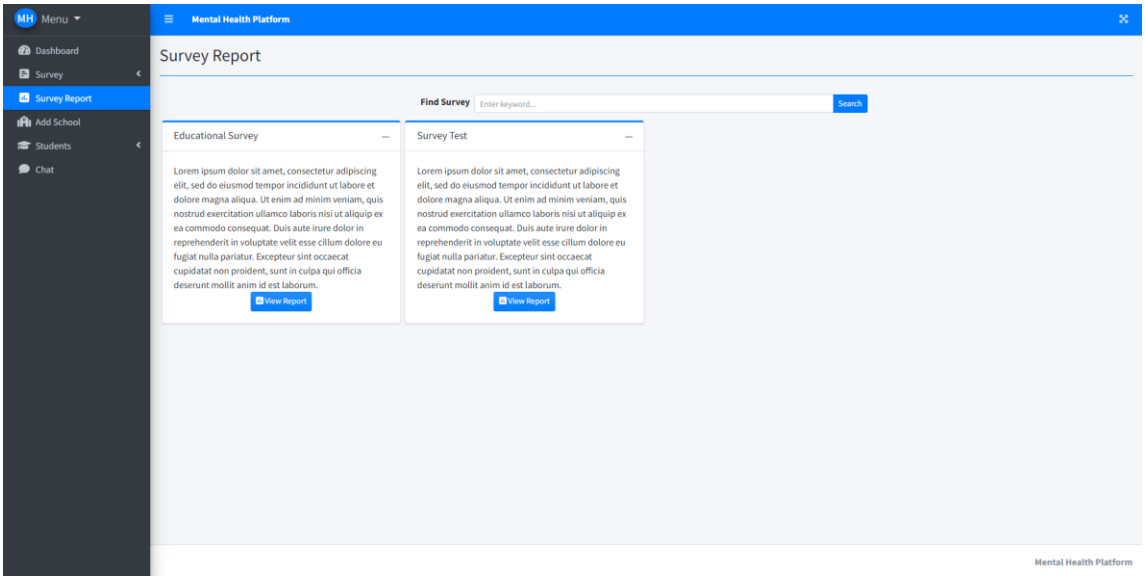

Figure 38. Mental Health platform Psychologist – Survey report list page

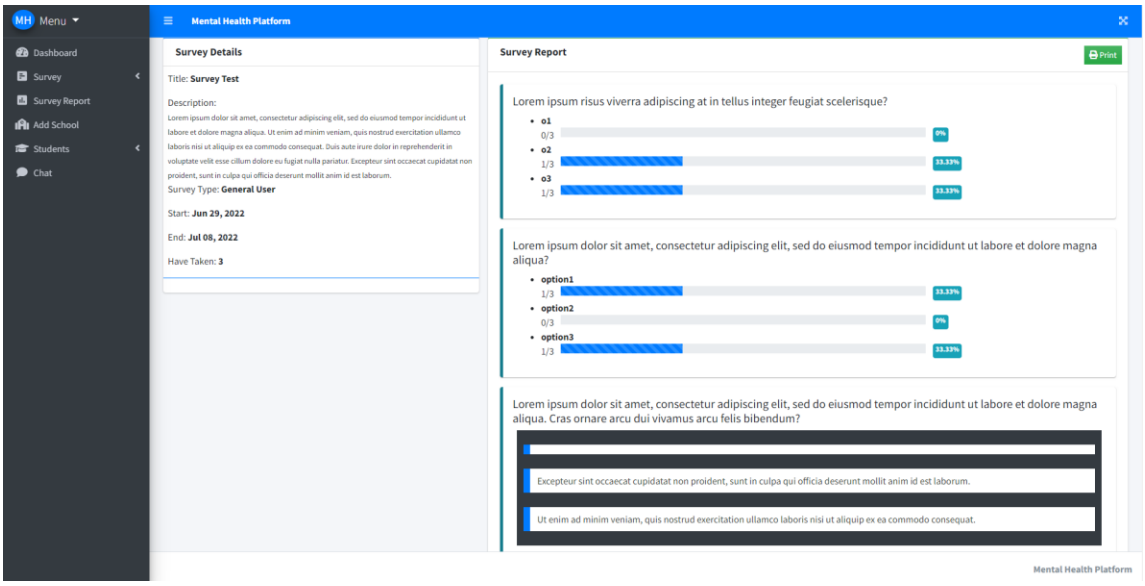

Figure 39. Mental Health platform Psychologist – Survey report page

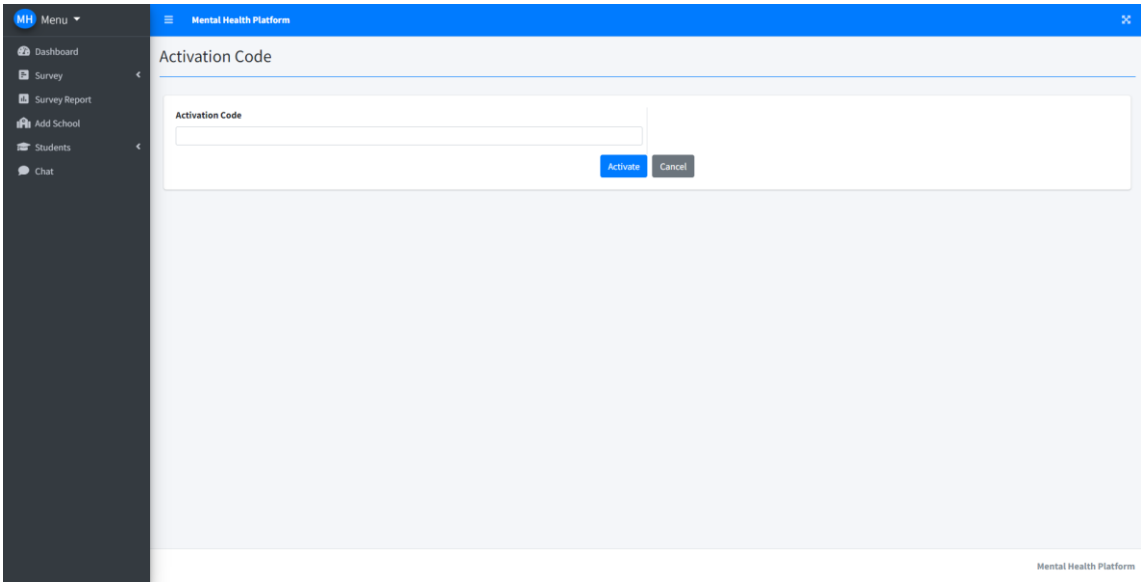

Figure 40. Mental Health platform Psychologist – Add school (not connected) page

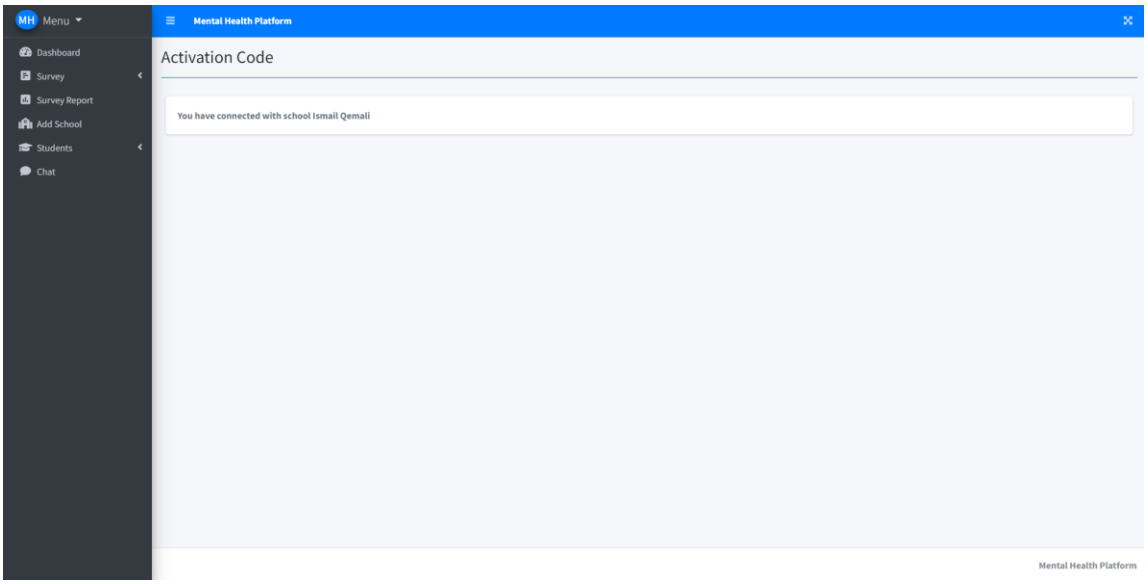

Figure 41. Mental Health platform Psychologist – Add school (connected) page

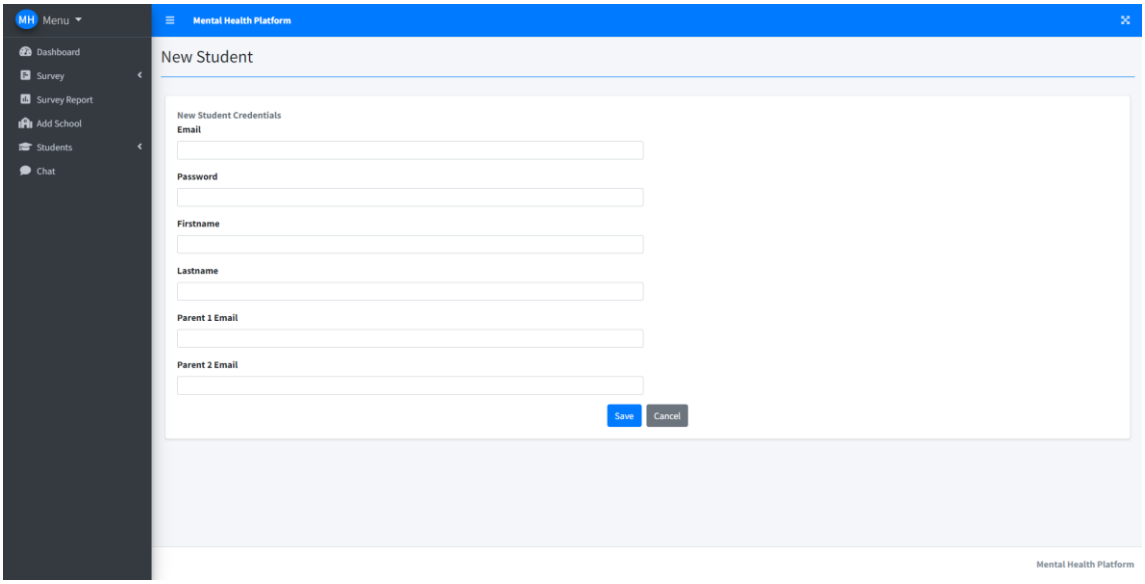

Figure 42. Mental Health platform Psychologist – Add new student page

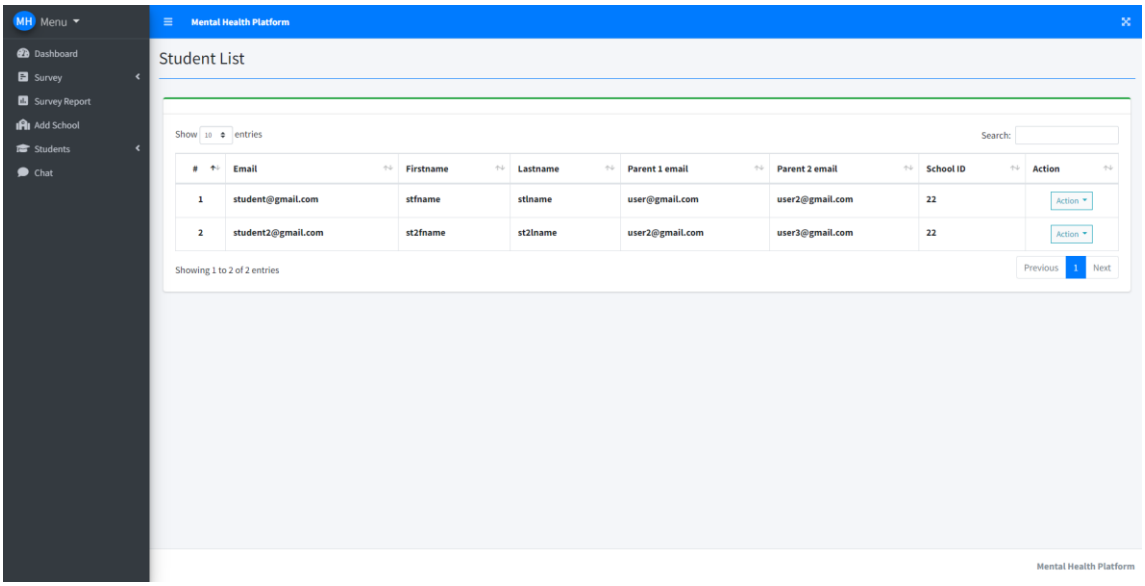

Figure 43. Mental Health platform Psychologist – List of students' page

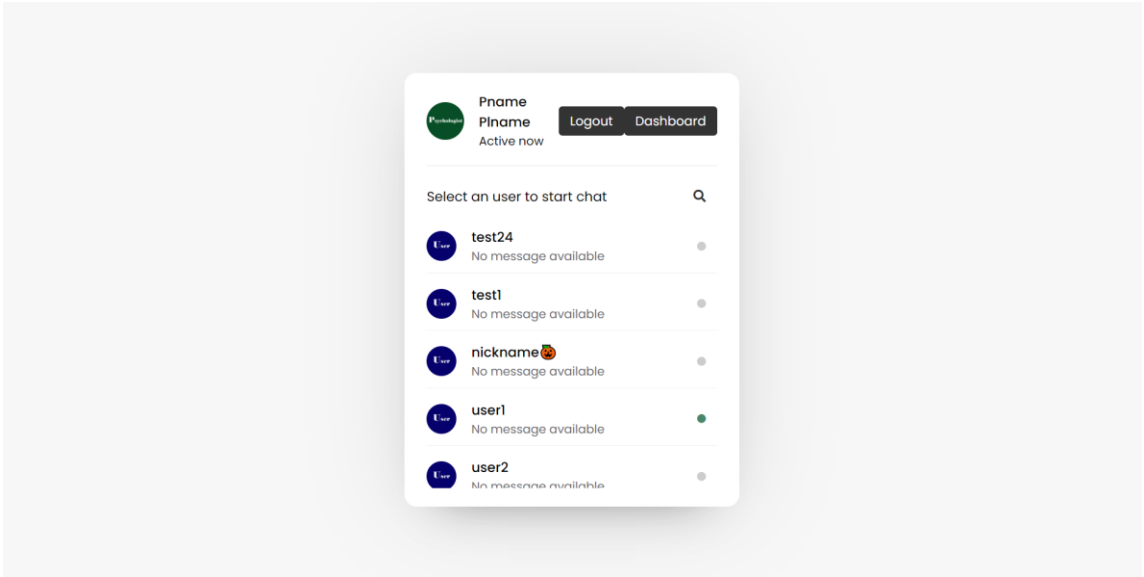

Figure 44. Mental Health platform Psychologist – Chat page

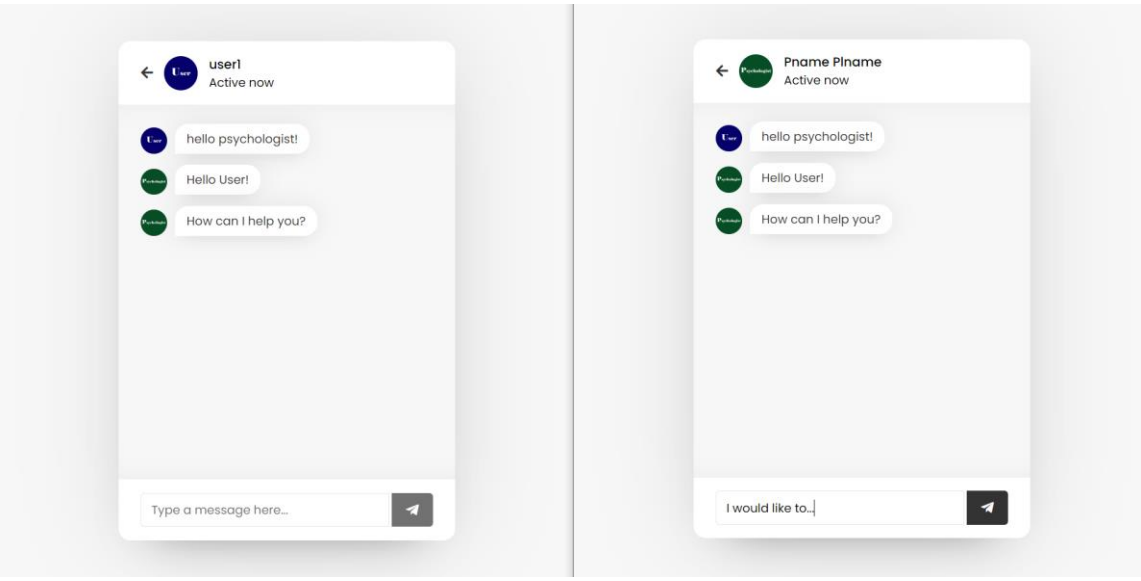

Figure 45. Mental Health platform Psychologist-User – Live chat session

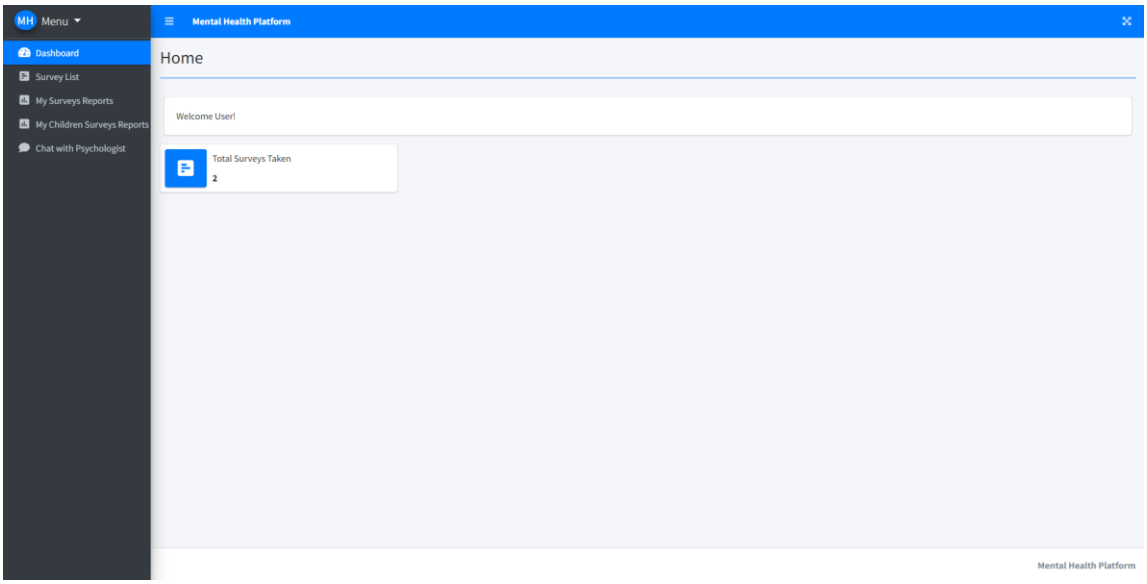

Figure 46. Mental Health platform General User – Dashboard page

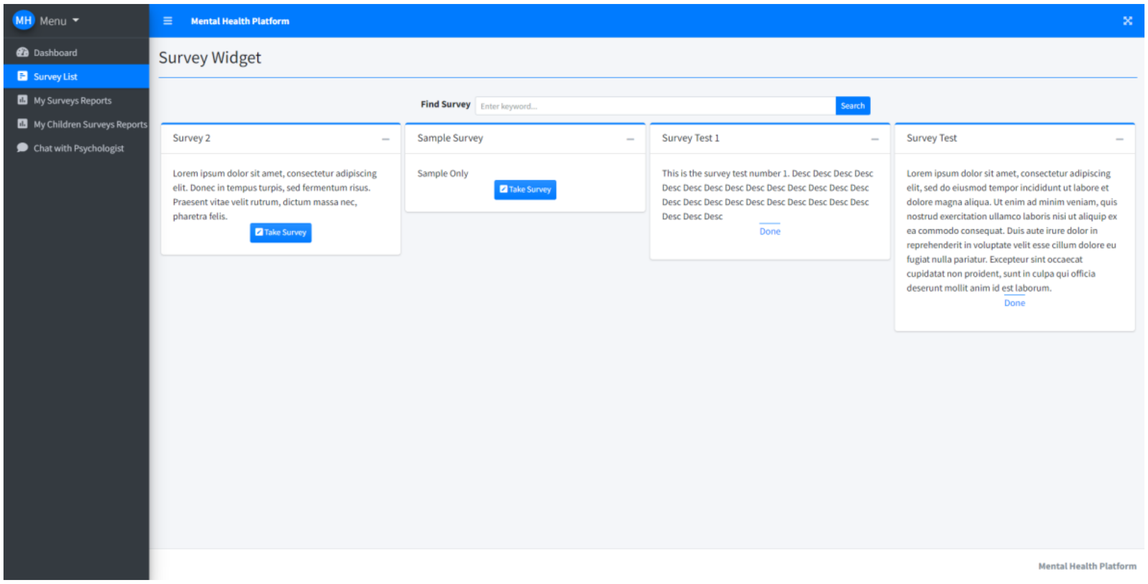

Figure 47. Mental Health platform General User – Survey list page

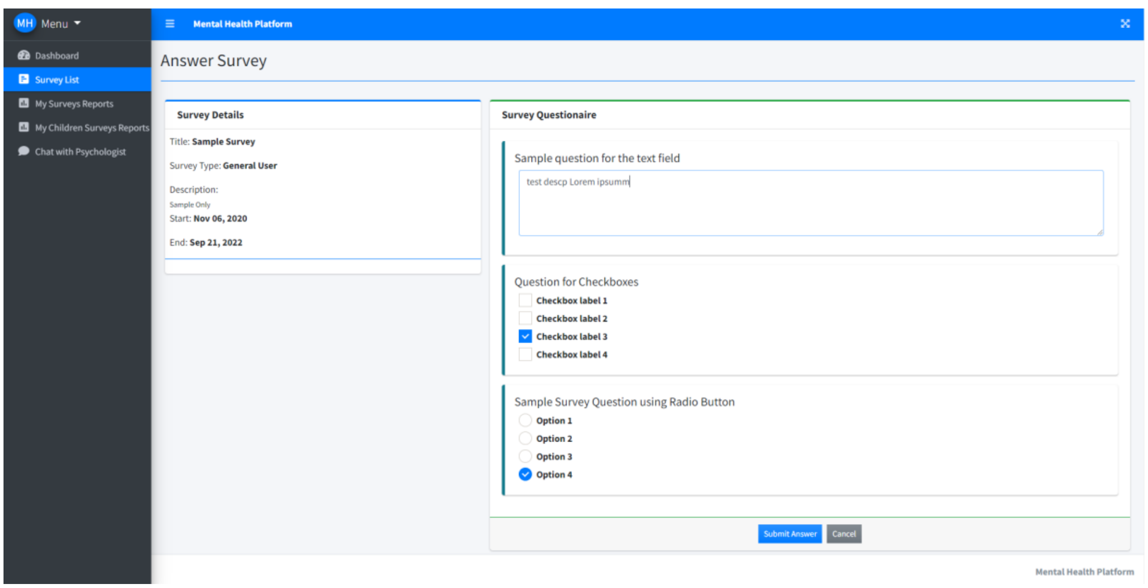

Figure 48. Mental Health platform General User – Answer survey page

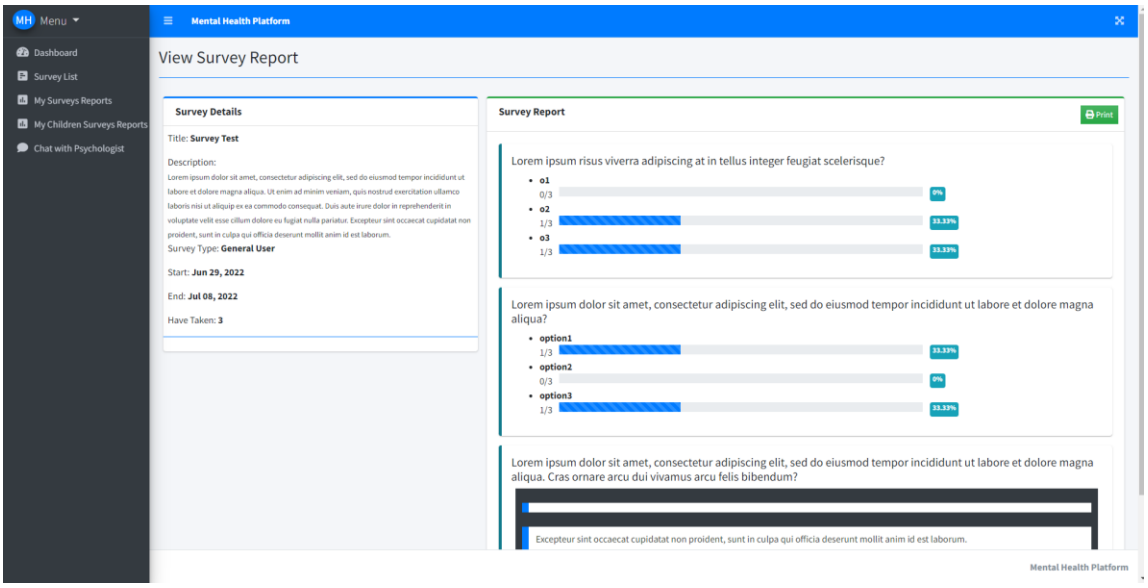

Figure 49. Mental Health platform General User – Survey answered report page

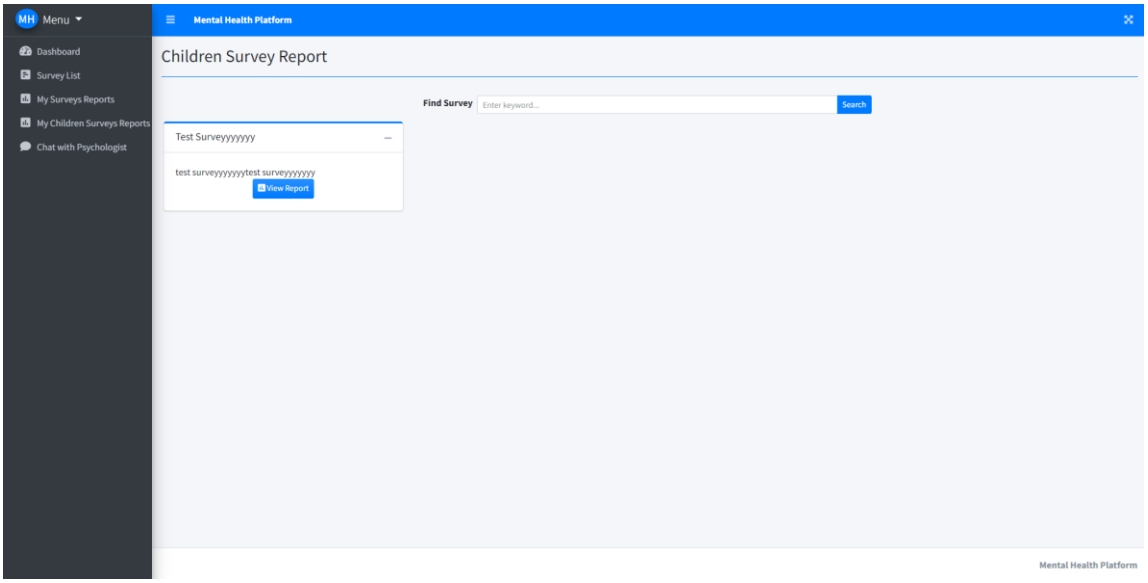

Figure 50. Mental Health platform General User – Children's school survey list page

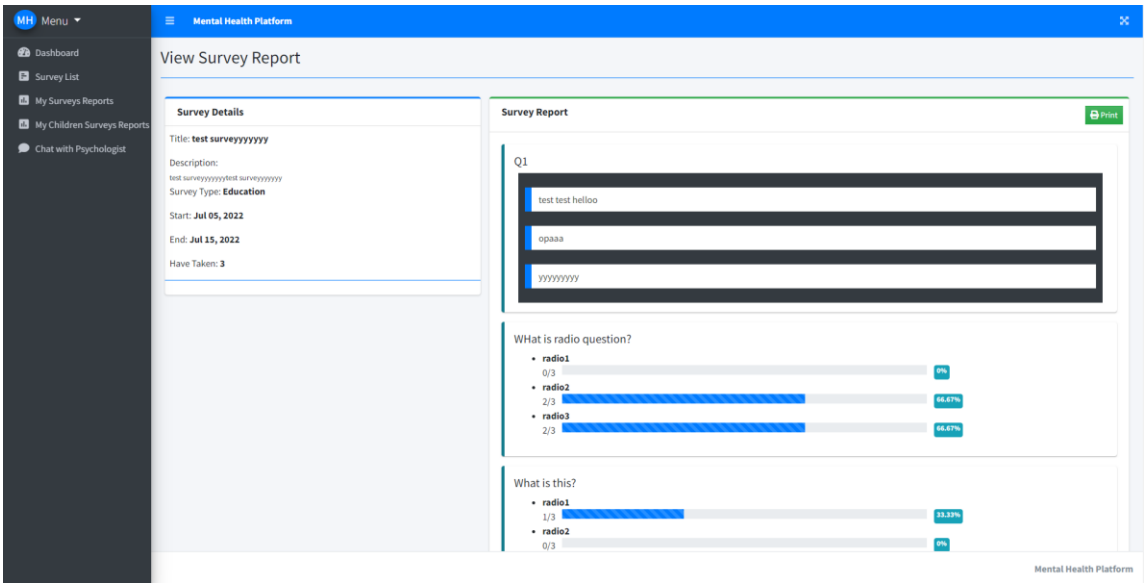

Figure 51. Mental Health platform General User – Children's school survey report page

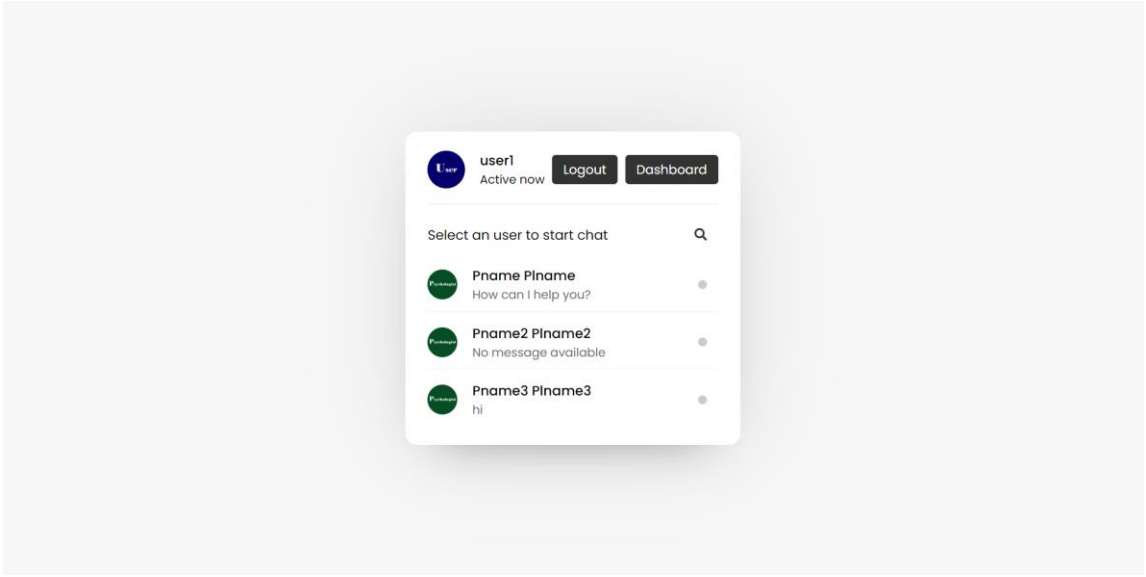

Figure 52. Mental Health platform General User – Chat page

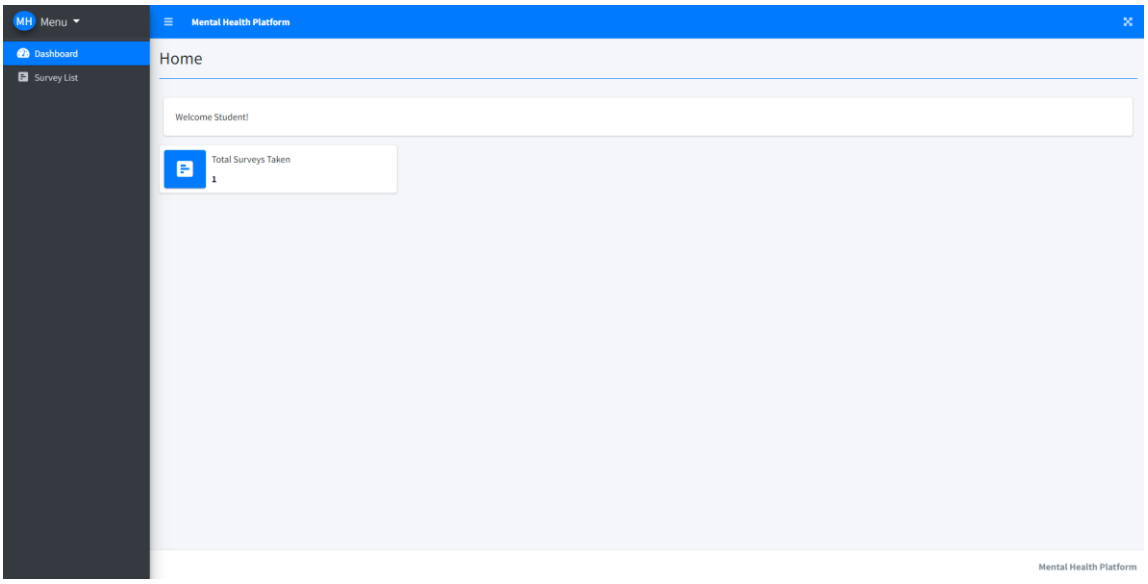

Figure 53. Mental Health platform Student – Dashboard page

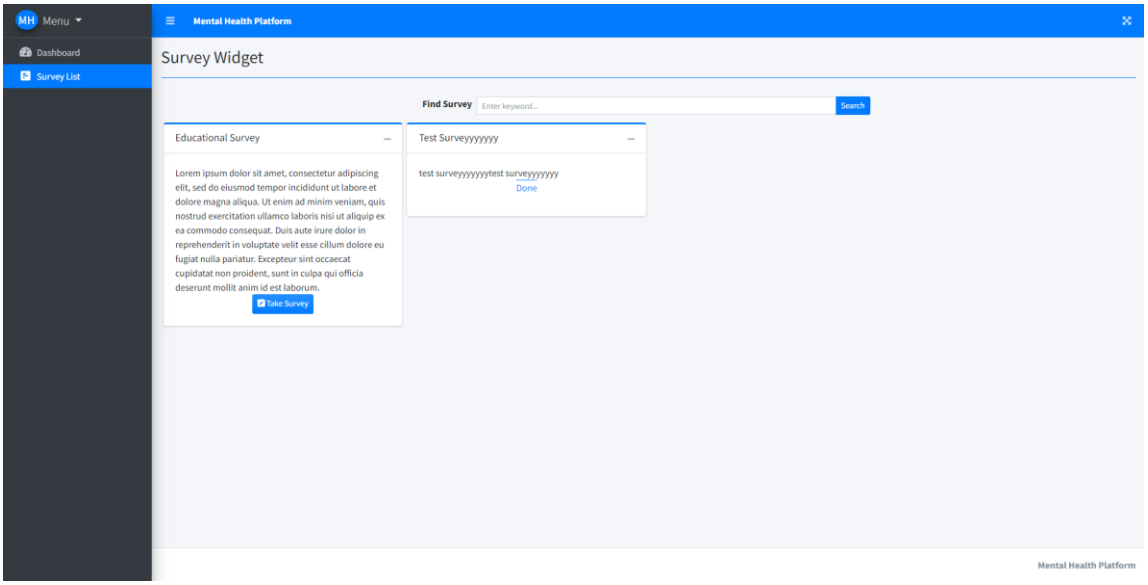

Figure 54. Mental Health platform Student – Survey list page

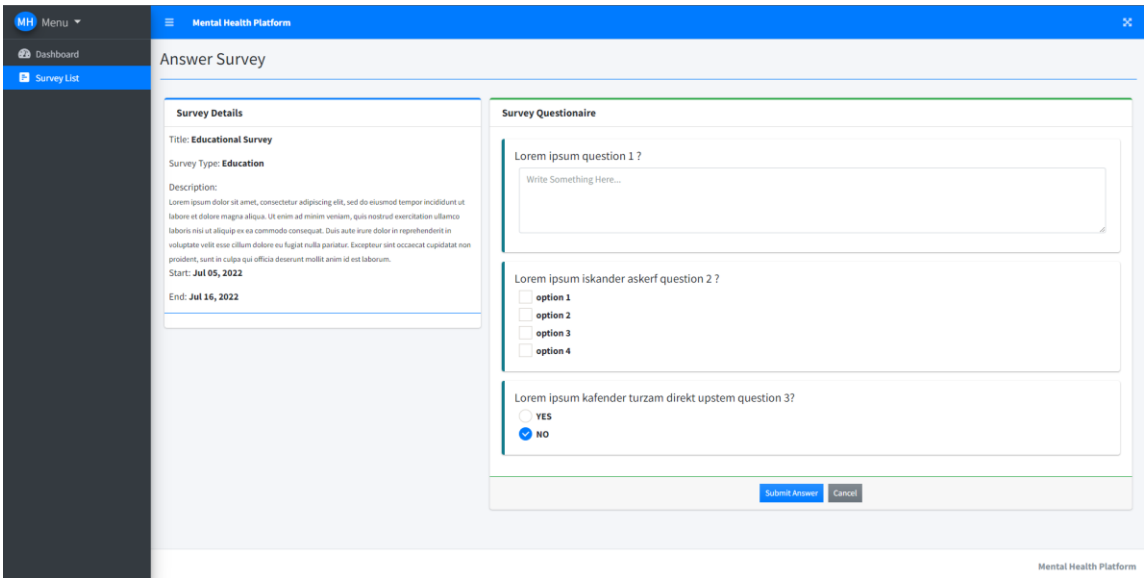

Figure 55. Mental Health platform Student – Survey answer session page

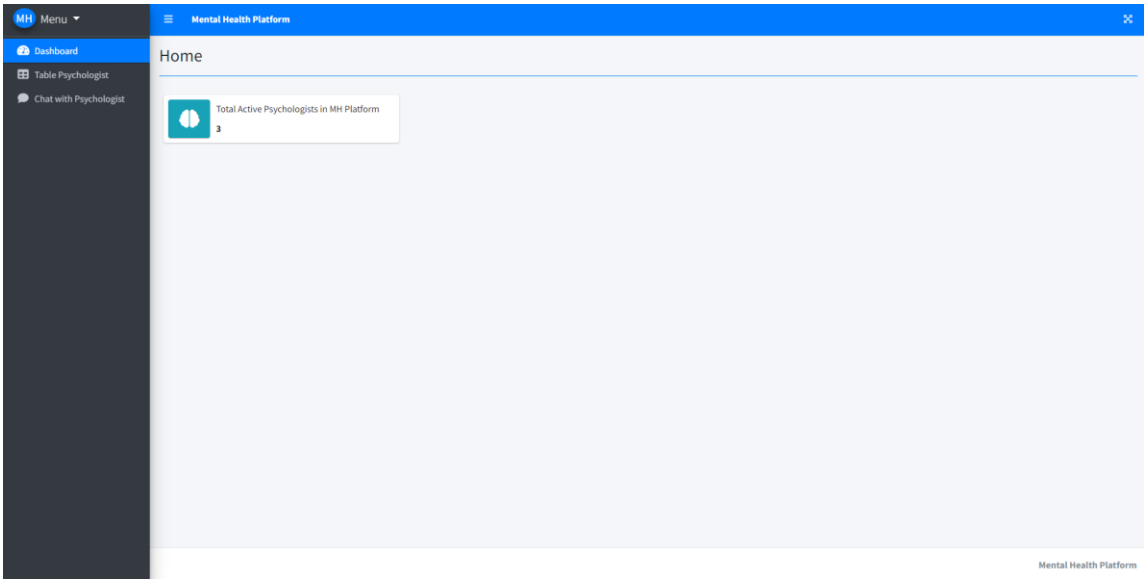

Figure 56. Mental Health platform Business – Dashboard page

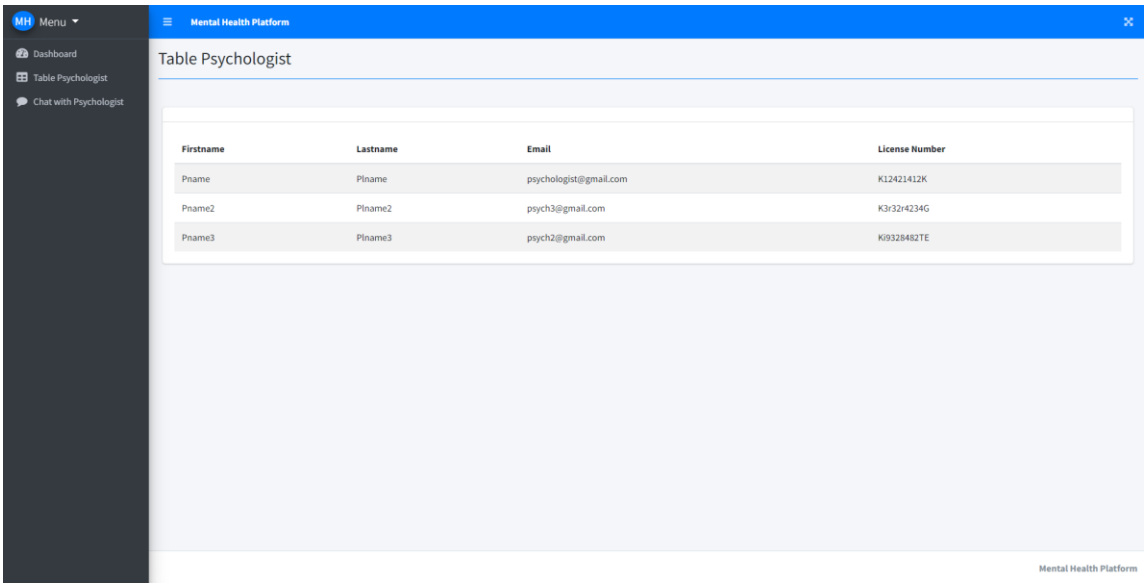

Figure 57. Mental Health platform Business – List of active psychologists' page

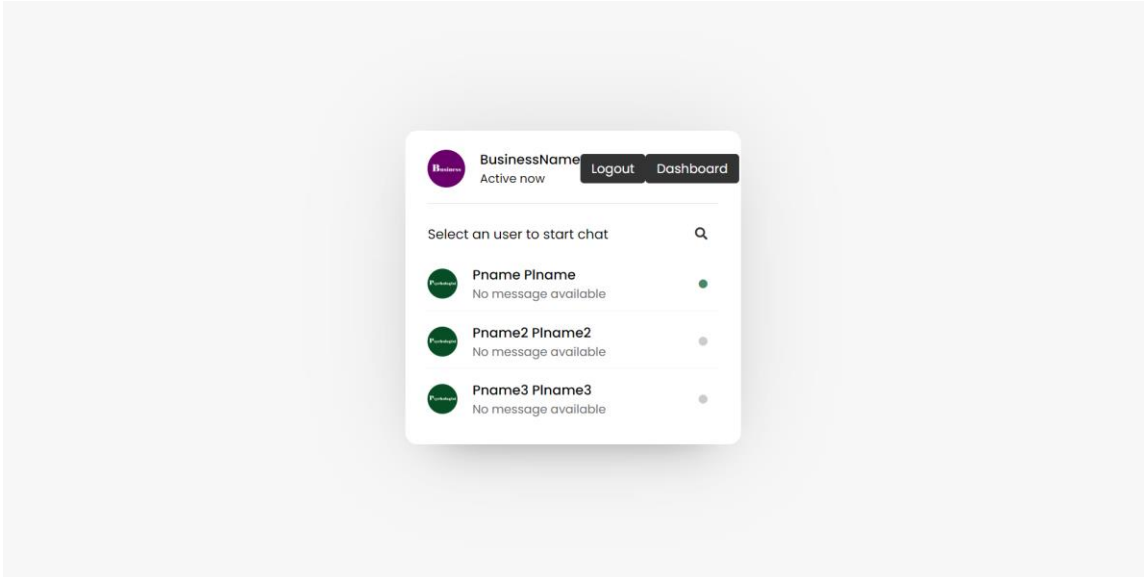

Figure 58. Mental Health platform Business – Chat page

APPENDIX B

DATABASE DIAGRAMS (ERD AND RS)

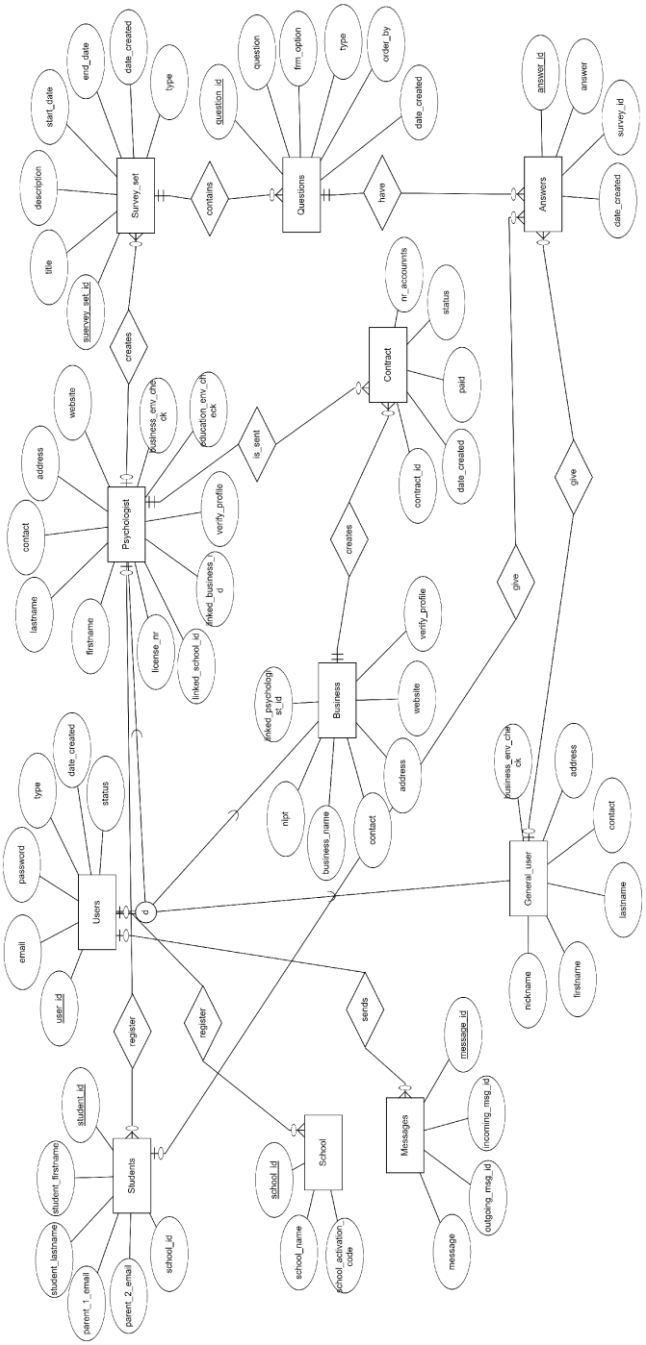

Figure 59. Entity Relationship Diagram (ERD) of the system's database

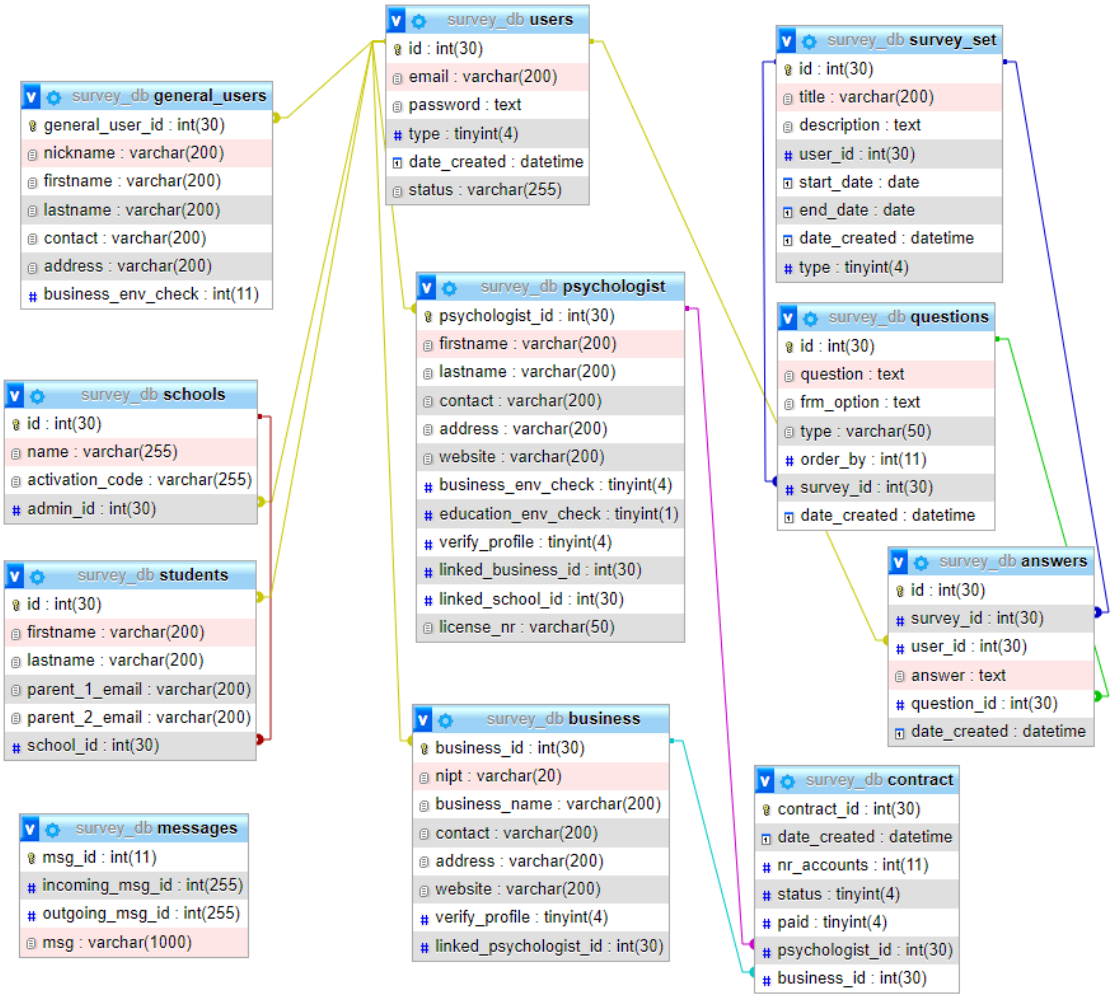

Figure 60. Relational Schema (RS) of the sytem's database